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Cutting Construction Costs

A DOLLAR saved in construction time, labor or material is as valuable to capital economy as one saved in the designing of equipment. The pressure upon field forces to complete installation jobs at top speed is so great under modern conditions that many in the power utility family do not realize how much thought is being devoted to combining cost "sharpshooting" with pushing the work to the point where operation may be started. Competent field engineers react to increased responsibility very quickly, and one of the basic factors in attaining construction economies is an organization which gives considerable latitude to the resident technical staff in exercising their ingenuity when confronted with obstacles.

It is desirable to give more study to the possibilities and limitations of standard equipment and material in this field, to the range of applications warranted for methods devised locally and under stress, and to the behavior of apparatus and personnel under the widest possible stretch of conditions. Where outwardly crude methods prove successful for temporary purposes, the lessons of experience are often swallowed up in the job itself instead of being made available throughout the practice of the organization. The trend today seems to be to give the resident engineering staff a freer hand in producing results than of old, but to strive to attain these results at well-controlled cost rates.

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Utilities and the Professors

A RECENT report of the National Electric Light Association committee on co-operation with educational institutions records a noble attempt to analyze the relations between the association and the field of education. The report is less conclusive and comprehensive than might have been hoped, but, nevertheless, does provide an admirable cross-section of the two areas by presenting hundreds of terse comments on the weakness in the present relationship as seen by individuals in both groups. The rapid evolution of the industry has made the need for handling its practical problems forge ahead of their infiltration into the academic pattern. One would be unreasonable to expect a cure of indigestion and growing pains in one treatment.

The report confirms certain things, and first among them is that the electrical industry has been far more receptive to co-ordinated activities in research and instruction and to employing college graduates than has been the railroad industry as revealed by the Yale survey on transportation. The opportunity for the college graduate in the electrical field is far more alluring than it has ever been in the railroad field, and we hazard the guess that the electical industry has provided an effective safeguard for its future by the more extensive employment of the college-trained material. The industry is reasonably well satisfied with the engineering recruit and, therefore, with the courses of instruction which prepared him for service. The concern is primarily with the courses in economics, accounting, law and business administration.

The real and immediate need indicated by the survey is a fuller realization by the electric utilities that research is the principal channel through which the teaching profession in general acquires its initial subject matter for instruction. Every approach to the utility by a professor or one of his responsible charges should be fairly met in an honest move to permit analysis and digestion of the ramifications—economic, political, sociological and technical—of the electrical industry. Those components which arise from the properly private aspects of the business must be differentiated most definitely from those which are inherently public.

It is earnestly to be hoped that educators in the fields of engineering, economics, business administration and politics may find the industry co-operatively disposed. Perhaps a more stable foundation can be established there than has been provided by two generations of ponderous progress in legislature, court and commission.

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Low-Powered Ties Have a Place in the Sun

HEAVY trunk-line interconnections have no monopoly of savings when "stacked up against" well-planned tie lines of modest capacity. A good engineering foundation is, of course, basic in the economic success of such enterprises. Given this, one can find some extremely interesting examples of tie-line service in fields which would attract only passing notice from an electrical engineer whizzing through the countryside at "40 per."

In a typical case a 33-kv. line 50 miles long connects steam and hydro plants of a power company at both ends and ties into a large paper-mill generating system near one terminal. In recent droughts not only has this line been able to aid in load transfers between the two divisions of the power company, conserving water as far as possible and loading steam plants of the non-base type more effectively, but in addition the paper company's plants have been utilized to better advantage. While an important boiler unit in the paper mill was being repaired, it was possible through the tie line to absorb available steam power from a plant at the further end of the line, meeting emergency conditions at doubtless increased cost per kilowatt-hour, but maintaining mill production.

A higher line voltage would doubtless be provided if this line were being planned under present load conditions, but even with the handicap of using 33 kv. and corrective apparatus installed since the line was built, the circuit has rendered fine service to the communities it traverses and reflects no little credit upon its designers.

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Peak-Load Capacity— What Is Most Economical?

CENTRAL-STATION executives and engineers, both here and abroad, have during recent years devoted much attention to the problem of the most economical plan for carrying the peak loads of their systems. No method capable of universal application has been developed yet, although certain arrangements provide satisfactory solutions in specific cases. When hydro-electric plants form a part of an interconnected system it is often possible to provide equipment in such stations that will carry the peak loads of the system more economically than by other methods.

In the case of steam-driven central stations peak loads can be carried by the older units in each plant which are not in operation at other hours. Where a new central station forms part of the system the older plant may be used for peak-load service.

The principal element in the cost of peak-load capacity is the fixed charges on the plant set aside for this service. The first cost of plant on which such fixed charges are based is therefore of first importance. As a result it has been suggested that special units of low first cost be installed only for peak-load service. Such equipment would permit the remaining plant to operate at higher load factors and therefore at better efficiency. The possible use of steam storage, gasoline or Diesel engines and of special turbines for peak loads has also been discussed in this connection.

It has generally been thought that the high first cost of hydro-electric plants would warrant their construction only when they could be operated wholly on such base load as the flow of the river would provide. This view is still correct for the main river flow. When a dam is built for such a plant a large pond is formed. This is generally utilized as storage from which to draw during low flow of the river. It is now realized that this pond has possibilities for carrying system peak loads at low cost.

If additional turbines and generators over and above base-load requirement can be installed when the plant is under construction, the cost per kilowatt of such added capacity is quite low—in fact, generally lower even than any similar capacity in steam plant. At the time of peak load these additional generators can be put into service and the pondage drawn upon over the peak. When the peak is past these units can be shut down and the pond allowed to fill again. The operating costs of such added hydro-electric units are much less than the operating cost and standby losses of a steam plant. During low-water periods the base load of the system can be transferred to connected steam plants and the hydro-electric station with its pond used only to carry the top of the load curve.

The low first cost and operating costs of such added hydro-electric equipment for peak-load service have appealed to many engineers. Equipment of this kind is provided in many of the newer plants, and additions may be possible in older stations. Hydro-electric plants in the future may not only be warranted as in the past to carry base loads but may also be justified as plants to carry a portion or all of the system peak loads at low costs.

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The Cost of Caution in Station Operation

CAUTION in an operating engineer is a valuable and admirable qualification. Undue caution, however, may lead to expensive and even wasteful methods of operation. It is therefore well to reconsider operating methods from time to time in order to determine whether certain procedures which have been initiated as a measure of caution can be economically justified by present-day conditions.

An example of caution frequently overdone by the operating man is the practice of maintaining an additional boiler in service over the number required to carry the immediate load purely as a precautionary measure. If the use of this boiler reduces the loads on all other boilers to values which permit most economical performance, its use would appear to be fully justified. But in general such use of the extra boiler extends over only a small portion of the day and during the remainder of the day it is banked. The losses from long-hour banking of this extra boiler offset and generally exceed any gains effected through increased average boiler efficiency during its hours of use.

The practice of carrying an extra boiler probably

started from some difficulty that occurred years ago when boilers and furnaces were less flexible and did not have the range of capacity of modern units. In modern plants it is generally possible to force the boilers remaining in service to higher ratings should it be necessary to drop a boiler and to carry these high loads until a cold boiler can be brought into line. Hence the practice of carrying the extra boiler as a precautionary measure is no longer justified, because it generally increases the station coal consumption.

Another common practice is to have a spare boiler-feed pump on the line. Here the justification of such practice is less sound than in the case of a boiler, for it is obvious that the power demands of two pumps at partial load must exceed that of one at normal load. Such pumps should be arranged for rapid starting in an emergency, and it should not be necessary to have an extra one always in service.

The use of an extra main turbine is justified by many operations on the basis of reliability of service. However, performance records of the station units should be analyzed carefully to determine whether this extra unit is really needed with the system reserve provided by interconnections. If not absolutely essential, steam is wasted by its use. These cases indicate that too great caution may result in needless expense and waste, particularly after the contingency has passed that caused the initiation of the practice.

Caution should be based on present-day data on performance of equipment. The object of a power station is to produce energy continuously, and the use of each unit in a station is fixed by the availability factors of feed pumps, boilers, turbines, generators and other essential equipment. Reserve equipment should be based on actual performance continuity and the reserve available through interconnections in the station and with other stations. The whole problem reduces to a balance of dollars and cents. But caution should be based on facts and not on tradition.

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Data Still Needed to Guide Water Heating

OFFHAND there would seem to be no simpler problem than raising the temperature of water by electrical means to household service requirements. But successful water heating by electrical energy—and this means economical heating in terms of service value to the user—is a complex undertaking. It is so large a problem, in fact, that an adequate survey of its limitations and treatment by engineers and commercial men demands many months, and indeed years, of hard work in committee activities, field coverage, compilation of practices and interpretation thereof. Hence expositions like the article of H. M. Ferguson on recent experience in Utah, published in the last issue, contribute to the industry's growing fund of information on this important subject and reveal the influence of regional conditions upon this class of service.

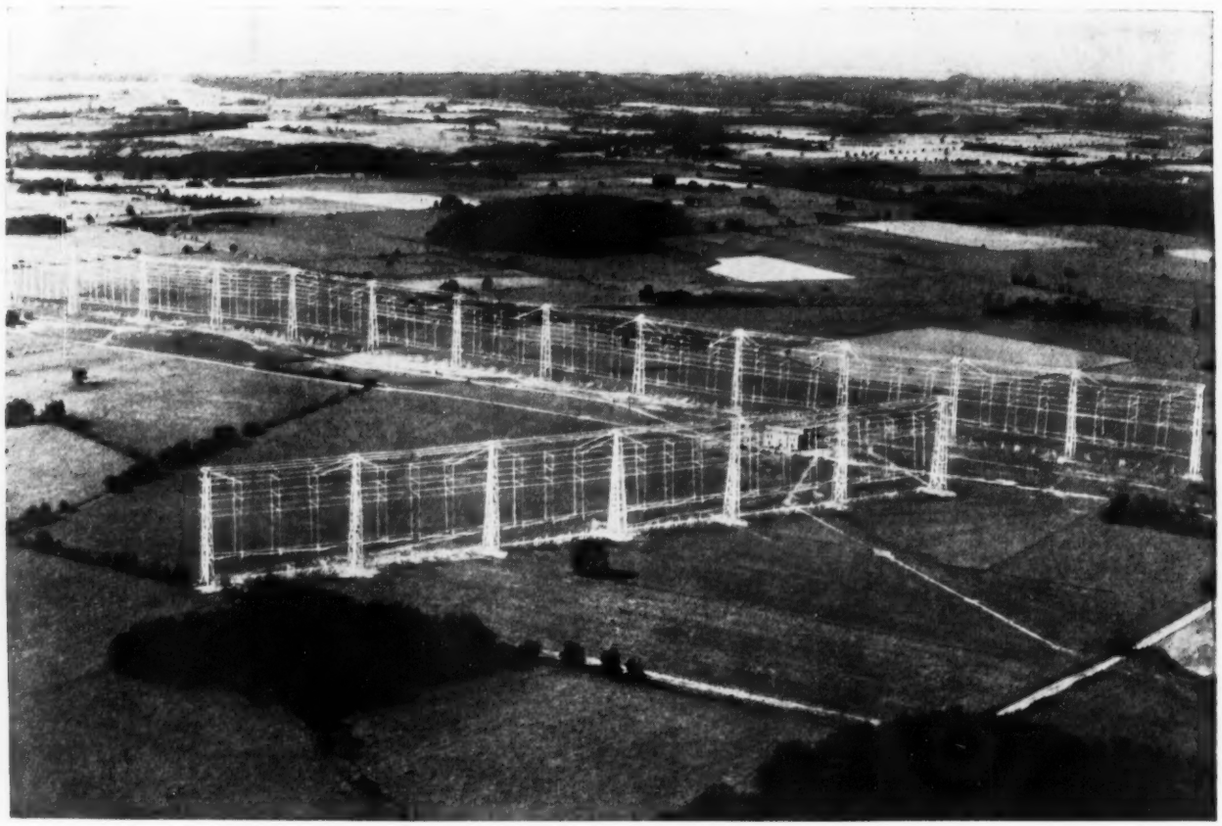
Definitions of what constitutes satisfactory water-heating service vary surprisingly throughout the country. After ten years' study of the problem the Utah Power & Light Company has settled, for the present at least, upon the use of clamp-on type heaters in connection with existing tanks and has attained the objective of low first cost, the lack of which has so long handicapped development in this field. Through concentrated sales activity, controlled construction practice and the application of a promotional rate with a minimum energy bracket of 1.5 cents net, used with a single meter and of course embracing every kilowatt-hour consumed in the home above a stated figure, more than a thousand satisfactory installations have been made.

Emphasis has been laid upon the cost of all residential electric service rather than segregation of water heating, cooking and other applications—a policy that might well be more generally adopted. Apparently this company has been able to steer pretty clear of the idea that electric heating of water as a domestic operation is a luxury, and certainly a $54 cash outlay for a 30-gallon tank equipment wired and installed complete is a challenging figure. It is interesting to learn that Mr. Ferguson finds clamp-on and insert heaters equally efficient for his purposes, and it is to be hoped that before long data as to energy requirements, water consumption, temperature curves and analyses of the load-building value of water heating on this system may be available to add the data of experience to engineering anticipations.

Even a brief study of the situation convinces one that it is dangerous to dogmatize on electric water heating at present. The variations in water consumption among families and between neighborhoods and communities are striking. Family habits run an amazing gamut: temperatures acceptable in one area may be out of the question in another; climate puts in its word, and the complexities of plant investment, idle capacity, peak and off-peak conditions, rate structures that fit local situations and the system-planning problem are a few of the elements which bear deeply upon this subject of such great interest to commercial men. Fortunately sales engineers and executives are becoming keenly interested in more thorough studies of water heating along economic lines and there is a growing demand for more penetrating knowledge of this topic. Standardization of methods may be far off at present, but it is none too early to chart the better courses toward success by interchanging the fullest available information as to specific experience and promising trends.

Right now there is need of convincing data on the relative merits of low-wattage and high-wattage heaters. If one type is better than the other, it should be known now before very many more installations are made. Possibly each excels in a certain field. This should be proved by experience or test data.

Voices Across the Ocean



THIS impressive array of transoceanic radio-telephone antennas, which is probably the largest in the world, is installed at Lawrenceville, N. J. The seven towers in the foreground support three separate antennas for transmission to Argentina and will be put in operation early next year. The line of towers at right angles to these support nine antennas transmitting to Europe. One channel is afforded to South America and three to Europe, but any one of three wave lengths—about 16, 22 and 33 meters—can be used over each channel. That wave length is selected which gives best transmission.

For these short-wave lengths curtain-type beam antennas of highly directive character are used, according to the American Telephone & Telegraph Company. They extend from the supporting insulators (180 ft. high) to the ground. Two curtains separated by about a half wave length are used. The curtain nearest the receiving station is energized with the transmitting wave, and the back curtain, which is similar but not electrically connected with the exciting curtain, serves as a reflector.

Nearly 800 papers were presented by engineers from 26 countries at the World Power Conference and World Engineering Congress which terminated in Tokyo November 7. Excerpts from some American papers of interest to the electrical field are presented here

Engineers of 26 Countries Exchange Views at Tokyo

Fujiyama, the Sacred Mountain of Japan

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Transmission Lines of Tomorrow

By E. W. Rice, Jr.
Honorary Chairman of the Board General Electric Company

A FIVE-MILLION-VOLT lightning generator has been added to the equipment of a manufacturing research laboratory. This gives a higher voltage than has been measured on any transmission line as a result of a lightning stroke. It is therefore possible to submit transformers, insulators and other electrical apparatus to electrical stresses greater than those which are likely to occur in practice. This laboratory work has been supplemented by some extensive studies of transmission lines under actual operating conditions. As a result, the methods of protection from the destructive effects of lightning on power circuits have been greatly advanced.

The interconnection of large electric systems is progressing rapidly and the economic advantages are found to be greater reliability of service, better "use factors" of expensive electrical apparatus which tends to reduce the amount of such apparatus needed for a given service supply and so favorably to affect the cost per kilowatt-hour of energy sold. One of the most important interconnections is that being arranged between three large systems in Pennsylvania. It is estimated that a saving in investment equivalent to $40,000,000 of power plant capacity will be realized.

The available power supply and its reliability are increased by interconnection and exchange through different watersheds. In some instances the diversity factor is improved by the fact that different parts of interconnecting systems operate in different time zones. These advantages tend to offset the handicap due to the increase in cost per kilowatt of generating stations.

The vacuum tube rectifier may prove to be of great economic advantage in connection with the transmission of power. These tubes may be used to convert the high-tension alternating current into high-tension direct current, which can be transmitted to the receiving station, where an inverted vacuum rectifier, known as the "thyratron," will change the direct current back into alternating current. Such high-voltage vacuum tubes give promise of not only being useful for transmission of large amounts of power to extremely long distances, such as 500 to 1,000 miles, but may have an important application in large cities.

In many cases the vacuum tube rectifier and thyratron system may increase by two or three times the useful power capacity of existing underground cables. The investment in such cables runs now into many millions of dollars and any practical method of multiplying their output will prove of unusual economic importance.

Transformers, especially those on

long transmission lines, are subjected to the shock of high-voltage impulse currents induced from lightning and switching which produce abnormal strains, irregularly distributed with the result at times of electrical failures. Important improvement has been effected by providing suitable electrostatic shields which insure a uniform distribution of the impulse voltage between the coils and turns of the windings. The resulting product, called a "non-resonating" transformer, is rugged and highly resistant to abnormal high voltage. This construction has been found practically to eliminate failures and at the same time has the added economic advantage of reduction in weight and size.

The transformer is probably the most efficient of all electrical devices. On account of its economic importance there is continued effort to increase these already high efficiencies. One manufacturer recently produced a 60-cycle transformer of 15,000 kva. capacity with an efficiency at three-quarter load of 99.53; a 20,000-kva. with an efficiency at full load of 99.52; and a 25-cycle, 83,333-kva. auto-transformer with the extraordinary efficiency at three-quarter load of 99.62.

Hydro-Electric Progress Reduces Costs

By F. D. Newbury
Westinghouse Electric and Manufacturing Company

THE greatest changes in water-driven generators during the past five years have appeared in the general type of construction. In common with other kinds of machinery, the construction and appearance of waterwheel generators have been markedly changed by the use of rolled steel plates and shapes fabricated by welding in place of iron and steel castings. This change in the use of engineering material is fundamental and its effects are far reaching. It is, perhaps, the greatest change in engineering construction that has occurred since our present industrial iron age.

Some major advantages of the new type of construction are: (1) Elimination of patterns required for castings; (2) shorter delivery is possible, partly due to the elimination of a pattern shop and foundry and partly due to the more intangible but nevertheless important advantage coming from concentration of responsibility for production in fewer hands; recently a 5,000-hp. synchronous motor for steel mill drive complete with base, bearings and shaft was built from new designs requiring new stator and rotor drives and special sizes for steel shapes ready for test in 82 days and was shipped in 90 days; (3) reduction in weight, and (4) the fabrication process lends itself to the design of certain machinery because of the ease with which the design may be modified to suit slightly different conditions.

Since the major cost element of hydro-electric power is interest and depreciation on first cost, any reduction in useful output results in an almost proportional increase in cost per kilowatt-hour. These considerations have led to the general practice of evaluating generator losses at the appropriate capital value and so determining the best generator efficiency for the particular application. The capital value of losses will vary between wide limits, depending on installation costs, the load factor and other conditions. The application of these principles to generator design has in many cases resulted in a demand for lower losses and large generators, and these cases justifying the greater first cost now have a full-load efficiency of 97 per cent to 98½ per cent, the exact value depending on kva., speed and frequency rating. These higher efficiencies have been made possible by the use of low-loss high silicon steel, reduction in armature I^2R loss, reduction in stray load loss and some reduction in windage loss.

A new development in method of excitation is the use of a pilot exciter to excite the main exciter. The combined effect of improvements in main exciter construction and the constant excitation provided by the pilot exciter has made it possible to secure sufficiently rapid voltage response in a large low-speed direct-connected main exciter. Improvements in the structural design of exciters have also contributed to this desired end of rapid flux control. An exciter of ordinary design may be capable of increasing its armature voltage at the rate of 50 volts per second. Low-speed exciters for direct connection to large vertical generators such as those previously mentioned have been built with a rate of voltage increase of 350 volts per second. High-speed exciters for synchronous condensers have a voltage-increase rate of 2,500 volts per second.

Hydrogen vs. Air Cooling of Rotary Equipment

	7,500 Kva. Air Cooling, Deg.	7,500 Kva. Hydrogen Cooling, Deg.
Stator winding temperature rise by detectors on bare conductors	57.5	47.0
Stator winding temperature rise measured by standard detector between coil sides	46.5	34.0
Rotor winding temperature rise by resistance at zero power factor	116.0	78.5
Calculated rotor winding temperature rise at 7,500 kva. 80 per cent power factor	77.0	50.5

10,000-Kw. Mercury Unit Cuts Fuel Bill $800 a Day

By W. L. R. Emmet
General Electric Company

A 10,000-KW. mercury turbine was placed in operation at the South Meadow station of the Hartford (Conn.) Electric Light Company following the experimental installation of a 3,000-kw. (maximum capacity) generator at the Dutch Point station of the same company. While minor boiler tube assembly difficulties required a shut-down after three weeks' operation, involving extended changes and experimenting, the alterations will not affect the operating economies reported in the accompanying table.

These figures show that the efficiency of the mercury turbine was somewhat better than expected, also that the combustion conditions and heat transfers in the surface beyond the mercury boiler were better than expected. The reduction of the gas temperature in the mercury boiler was materially less than was intended, and it is thought that this can be corrected by the introduction of certain baffles which will prevent by-passing and force the heated gases to pass through the heating surface of the mercury boiler in the most effective manner and with a distribution which should be equal instead of very unequal, as in the trial. The correction of these defects would put more heat in the mercury and thus improve the net economy.

Such steam as was made in this trial, if used in the best large apparatus and

Test and Design Economies of Mercury-Vapor Unit Show Close Agreement

	As Designed	From Test*
Output of mercury turbine, kw.	10,000	10,300
Speed of mercury turbine, r.p.m.	720	720
Steam produced per hour, lb.	125,000	130,000
Steam pressure, lb. gage	350	270
Steam temperature, deg. F.	700	810
Mercury vaporized per hour, lb	1,150,000	
Temperature mercury vapor, deg. F.	884	880
Pressure vapor at mercury turbine, lb. gage	70	68
Vacuum in mercury condenser, in.	28	28.5
Temperature mercury exhaust, deg. F.	458	
Gas temperature beyond mercury liquid heater, deg. F.	950	1,100
Gas temperature beyond steam superheater, deg. F.	650	720
Gas temperature beyond water economizer, deg. F.	480	
Gas temperature to stack, deg. F.	280	310
Air temperature entering furnace, deg. F.	390	400
Coal burned per hour, lb	14,500	15,500
Heat in coal per pound, B.t.u.	14,500	14,300

*Highest load trial run.

with the best methods of regenerative feed heating, would produce 14,000 kw. plus all necessary auxiliary power. We should thus have 24,300 kw. from a consumption of 15,500 lb. of 14,300 B.t.u. coal per hour, or 9,140 B.t.u. per kilowatt-hour.

In future applications of this process the mercury heating surface on the walls of furnaces may be used. This will give a means of delivering more of the total heat of the fuel to the mercury vapor and will also make it possible to dispense with the economizer and to use more air heating and a much greater application of regenerative feed heating. The figures given in the table clearly indicate that under such improved conditions a properly designed plant with the best steam apparatus could produce power at the rate of 8,800 B.t.u. from fuel per net kilowatt-hour.

This unit, while operating, was actually saving its users about $800 per day in fuel alone. Except in the boiler, there was no trouble and no observable deterioration. There was no erosion in the mercury turbine, the furnace showed no deterioration and the heating surface was easily kept clean.

Plans for the further development of this process include carrying considerable degrees of overload by the simple increase of firing, accompanied by increase of pressure in the mercury vapor. By using a larger generator and a little different arrangement of heating surface a pressure of 100 lb. gage will give more than 40 per cent increase of output from the mercury turbine and, owing to the higher temperature limit, the fuel efficiency will be better, notwithstanding the greater congestion of the apparatus.

Total Temperature Basis for Turbo-Generator Operation

By Philip Torchio, W. J. Foster and F. D. Newbury

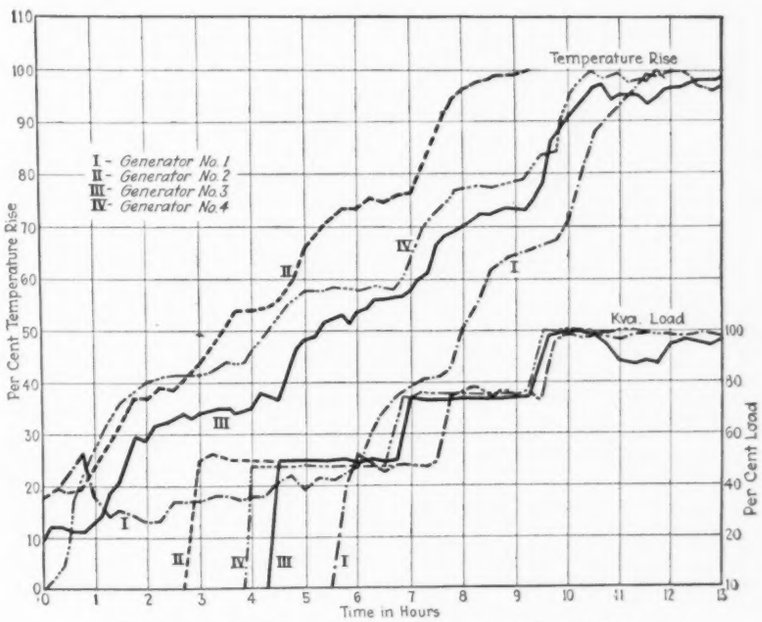
New York Edison Company, General Electric Company and Westinghouse Electric & Manufacturing Company, Respectively

IN DISCUSSING the application of the total temperature basis of loading, the subject of rating is of major importance and due consideration must be given to all the factors affecting capacity. For the purpose of this discussion it will be convenient to make a distinction between the contract or nameplate rating, which is of primary interest to the designer, and the more comprehensive operating rating, with which the operating engineer is concerned. Limits to ratings from the standpoint of the operating engineer are not quite the same nor as simple as defined by the designer for contract purposes. The designer defines ratings quite simply by limiting temperature rise and kva.

Previous to the last few years this nameplate rating was substantially the operating engineer's only guide to the loading which might be placed upon generators. Nameplate rating includes the following measurable elements determining generator output: (1) Allowable temperature rise of the stator windings; (2) allowable temperature rise of rotor windings; (3) ability of exciters to maintain maximum specified voltage at specified kva. and power factor, and (4) ability of generator exciter and voltage regulating system (if any) to maintain generator in synchronism during ordinary operating load fluctuation. It may be noted that: (1) turbines are normally operated at their most economical load point; this is seldom more than 0.8 of the maximum capacity of the turbine, which usually approximates the nameplate rating of the generators; (2) in central station systems it is necessary that sufficient generator capacity be in operation at all times to take care of any probable load increase, either due to increase in demand or loss of one of the other units in operation on the system. Thus it is likely to follow that during the greater part of the day the generators in operation will be carrying loads considerably below the nameplate rating.

Operating experience has shown that many stator winding failures and a still larger proportion of rotor winding failures are caused directly or indirectly by abnormal movements of windings or insulations, such as bulging or wrinkling of insulation in armature coils and the abrasion of insulation in rotors due to the longitudinal expansion of long coils. These relative movements result from temperature differences within the structure, which in turn are a direct function of current loading, so that the relative movements of the constituents are increased by any output above the nameplate rating.

Many of the operating companies have temperature recording instruments in service that either trace the curves or stamp the temperatures of several imbedded detectors, including temperature of ingoing and outgoing air at stated intervals. A few of the operating companies are equipped with instruments for determining the temperature of the field winding as a whole, the equipment being calibrated to read temperatures from resistance as determined by the voltage at the slip rings as related to the ampere excitation at the moment. The operators are usually instructed to notify the plant engineer if any reading exceeds a predetermined value. The figure specified is ordinarily based upon heat run data and is often fixed after consultation with the manufacturer. In deciding upon the temperature it is the general practice to be conservative and use a figure that is somewhat lower than is considered safe for the insulation; 90 deg. C. as measured by imbedded detectors between coil sides has been used in a number of cases as being conservative and leading to very long life of the insulation. The temperature readings taken are utilized in general for the following purposes: (a) As a general check to make certain that no excessive temperature is developing; (b) as a check of ventilating conditions; (c) as an aid in despatching wattless kva.; (d) as a guide in distributing emergency overloads. As indicated under (c) and (d) the temperature indicators are quite generally used as a basis for despatching wattless kva. and emergency overloads. Some companies are of the opinion that as far as



Comparative Temperature-Time and Load-Time Curves for Four Generators

stator temperatures are concerned they will be able to carry overloads on their generators, but that they are limited in other respects, some by a shortage of capacity on the steam end of the unit and others by temperatures of the field. One operating company reports that two 25,000-kw. generators on its system have sufficient excess service capacity to deliver 35,000 kw. and that by operating on a total temperature basis under favorable conditions it was feasible to make the entire 35,000 kw. available. In many instances overloads of the order of 15 per cent based on the nameplate rating of the generators have been carried repeatedly with total temperature well within the limits of safety.

Very little data now exist as to the actual effect in practice from operating generators at overloads involving temperature rises appreciably in excess of those corresponding to nameplate ratings.

In general, the idea of operating on a total temperature basis is gradually establishing a more substantial foothold in practice and advantages have already accrued to operating companies in many cases. It is believed that as time goes on operating engineers will become more skilled in the interpretation and use of the temperature measurements available and that they will gradually find themselves better prepared to realize upon the full capabilities of their generator capacity.

Basis for Standards and International Need

By C. E. Skinner

Assistant Director of Research Westinghouse Electric & Manufacturing Company

MUCH of the remarkable progress which has been made in the industrial world during the past few decades has been due in part to standardization which has permitted quantity production at low unit costs. But standardization requires more than the adoption of a simplified list. It also requires the selection of the best and most efficient, and frequently involves the formulation of exact specifications and tests by means of which standards may be judged. Research is frequently called in as an aid to standardization.

The agencies responsible for adoption and administration of these standards vary with the different kinds of standards and also differ among the twenty-two countries which have organized standardizing bodies. Standards of safety are becoming very important in industry and standard safety codes are being adopted in various countries.

The standards which have been adopted and used have in no sense been a bar to progress and there should be no fear of standardization reaching the point where there will be a drab sameness in goods, manners, dress and customs. Standards should be an aid and not a bar to progress. No standard in any field is really satisfactory unless satisfactory to all parties at interest.

The standardization already accomplished is of very great value, but a larger program, both national and international, is essential in order that the maximum possible benefits may accrue.

Turbine Design Trends

By Ernest L. Robinson

General Electric Company

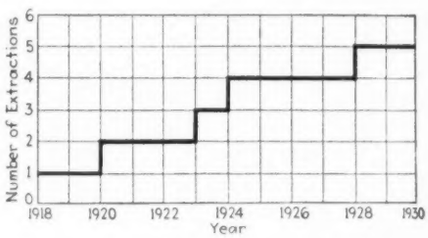
THE accompanying charts, while indicative of maximum capacities, temperatures, pressures, etc., for the units manufactured in any one year by but one company, fairly reflect the general tendencies in the art.

Seven hundred and fifty deg. F. represents approximately the limit at which materials can be trusted to maintain dimensions under stress. Active researches are being carried on with the intention of raising this limit and there is perfect willingness at the present time to construct for 800 deg. F.

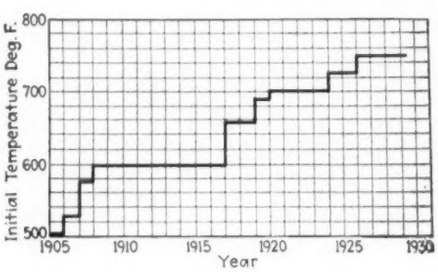
The economic significance of the regenerative principle development is twofold. At one and the same time it decreases the fuel consumption of the turbine per unit of electric energy generated and enables the same size of turbine to handle a distinctly larger capacity for the same investment. This may be easily appreciated by noting that the condensing plant is, with the regenerative process, distributed through a number of units and able to draw steam from several points of the turbine shell instead of having to receive it through a single congested passage.

An accompanying chart shows how nearly the heat rates of the best turbines now built approach the ideal condition. If economies are to be effected in the next decade beyond present accomplishments and at a rate corresponding to that in the past decade the changes must be along new lines.

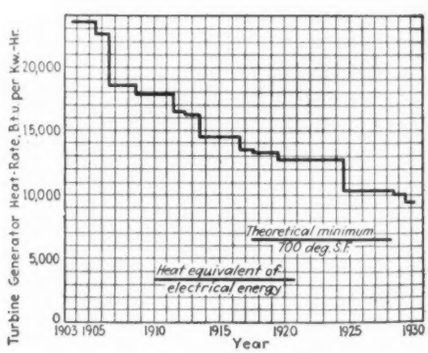
Increases in initial pressure have been due to theoretical improvement in the steam cycle due to the absorption of heat in the boiler at the higher temperature rendered possible by the greater pressure. The justification for this step lies in the success of the stations which have adopted it as reflected in the subsequent trend of business. There are now in operation or under construction by the General Electric Company 363,700 kw. capacity of turbines for 1,200 lb. per square inch pressure.



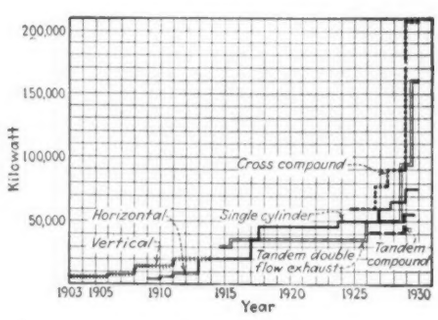
Number of Extractions for Feed-Water Heating Continues Upward



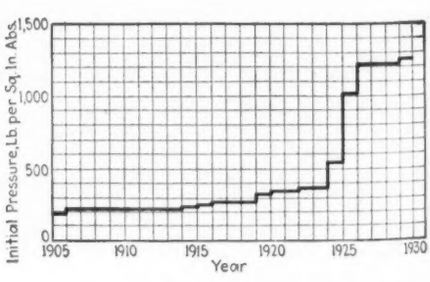
Maximum Steam Temperatures Reach 750 Deg.



Heat Rates Approach Theoretical Minimum



Maximum Rated Capacity of Turbines Increasing Rapidly



Maximum Steam Pressures Now Advance Less Rapidly

Lightning and Safeguards

By F. W. Peek, Jr.
General Electric Company

THE wave shape of induced lightning voltages varies over a large range. It seems probable, however, that high-voltage waves reach a crest in one to five microseconds and have an effective duration above half voltage of 5 to 20 microseconds. A high-voltage traveling wave generally ranges from 2,000 to 5,000 amp. Lightning breakdown voltages are always higher than 60-cycle breakdown voltages. Induced voltage increases directly with the height of the line and ground wires usually reduce the voltage to about one-half.

Whether the front or the tail of the wave controls lightning sparkover depends on the voltage. Sparkovers have occurred after the tail of the wave has decreased below the 60-cycle value. Apparently the breakdown effect, once started by the overvoltage, continues. When the front is relatively short the instantaneous breakdown voltage depends largely on duration of the tail.

Efficacy of Grading Rings

While insulation sparkover voltage to lightning waves may be increased by a grading shield, the 60-cycle sparkover voltage may be lowered. This is not a handicap because lightning surges having an impulse ratio of unity have never been observed in practice. For clearing the dynamic arc, round, or oval rings are highly desirable.

Measurements show that the insulating value of wood poles, with varying degrees of wetness or dryness, ranges from 100 to 300 kv. per foot; 180 kv. per foot being a good average value. Thus a pole 35 ft. high with a 5-ft. crossarm would have a lightning sparkover voltage of $40 \times 180 = 7{,}200$ kv. In a case of this kind, part of the insulation of the pole could be utilized, and protection from splitting afforded at the same time by placing a gap in series with the lightning rod.

Whether a pole is wet or dry makes very little difference on the lightning flashover voltage. However, when a pole is quite wet, incipient sparks will take place over the insulator string at voltages approximating the lightning sparkover voltage of the insulator string. Such simultaneous surface discharges may create sufficiently ionized paths for a power arc between phases to follow.

While wood poles without rods or ground wires may have very high lightning sparkover voltages, there is always a danger of long operating delays due to split and burned poles that cannot be tolerated on important lines.

If insulator sparkovers do not result at the initial maximum induced voltage, the charge separates into two traveling waves which move over the line at the velocity of light. The front of the waves will probably be of the order of one or two times the length of the cloud. If lightning strikes the line, an insulator sparkover is sure to follow and a short chopped wave of steep front travels over the line. If the voltage is high, there is considerable attenuation due to corona and other losses.

When the wave reaches the end of a line the well-known reflection to double voltage takes place and all of the energy becomes electrostatic.

If the end of the line were connected to a transformer and a large bus structure, the voltage might be reduced below its incoming value. Extra ground wires at the station end, by decreasing the surge impedance, also cause a reduction in voltage and reflection as the wave reaches the bus. When a wave strikes an inductance coil in series with the line, part is reflected back over the line and part goes through. The latter part may cause very high voltages and oscillations if the end is open or if it is closed by a transformer.

Data have been obtained which show that outages due to insulator arcovers are reduced from one-half to one-tenth or more after the installation of ground wires. Furthermore, they reduce the surge impedance and thereby reduce the voltage of traveling waves coming in from other sections.

A study of the various factors shows that a line of moderate height, protected by ground wires and properly insulated, can usually be made lightning proof against induced voltages at a reasonable cost. For example, assume that the average height of the horizontal conductors is 40 ft. Then $V = 100{,}000 \times 40 = 4{,}000{,}000$ volts or 4,000 kv. With one or more ground wires the voltage will be reduced to at least $4{,}000/2 = 2{,}000$ kv. Insulator units are found with a margin well over this.

Ground Wires Needed

To avoid direct strokes the necessity of ground wires above the line is almost obvious. With ground wires the stroke would usually strike the wires and follow them to the tower, preventing insulation arc-over. However, where the line is badly exposed to direct strokes, where the spans are long or where the grounding resistance is high, special precaution should be taken in the design of the tower to prevent side flashes from ground wire to conductors. To assure immunity from direct strokes to the conductor, rods at the towers or alongside the line, or additional overhead ground wires might be used, and the special precautions taken as to length of span, resistance to ground, distance from conductors to ground wire, etc.

It is very important, when designing a system, to so proportion the insulation that the lightning strength of the transformer is higher than the lightning breakdown voltage of the line insulators in the vicinity of the station. The insulators on the remainder of the line may be as strong as desired.

A study of most lines shows that a large percentage of over-voltages occur on limited sections of the line. If these bad sections could be determined before the construction of the line it is prob-

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THE WORLD ENGINEERING CONGRESS at Tokyo is one of transcendent importance, not only in its economic aspect, but, presaging as it does the spirit of co-operation among the great scientists of the world, to carry on research and to interchange information of inestimable value to industry and to the progress of civilization. Science recognizes no political boundaries. No tariff walls or embargo can prevent the interchange of results of scientific investigations which promote the higher standards of living and well-being of people of all nations.

JOHN HAYS HAMMOND.

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able that the route could be changed to avoid them. The ideal line would thus be as low in height as practicable, and should be protected by one or more ground wires, and well insulated with insulators protected by grading shields. Unavoidably exposed sections on the right-of-way should have extra insulation and additional ground wire protection. The transformer insulation should be stronger than the bushing and the bushing stronger than the sparkover voltage of the line insulators in the immediate vicinity.

Electric Locomotives Have Proved Many Advantages

By Dugald C. Jackson
Consulting Engineer Jackson & Moreland, Boston, Mass.

IT IS difficult to compare, with respect to ruggedness and simplicity, two such different structures as a steam locomotive and an electric locomotive. The fuel economy and high continuous capacities of modern steam tractive units have unquestionably reduced ruggedness and increased the frequency and cost of repair. Continuity of service and cost of repairs per locomotive mile prorated to equal service conditions are the test criteria for the two sources of motive power. Experience plainly shows the superiority of properly selected electric locomotives with respect to these factors and further advantages seem to be available to electric locomotive designers who face many possibilities to enlarge on improvements that may be developed before the engines average their fullest adaptability to American railroad traction. They already have proved their economic serviceability where suitably applied.

Further analysis of the conditions to which the resources of electrical engineering may be economically employed will enable designers to improve further the qualities of electric locomotives. Discarding tradition in certain details both of steam locomotives and of electric motor construction will prove essential to this progress. A spur to the study of improvements by the makers of electric locomotives lies in the lower first cost of steam engines, which now is normally of the order of 55 to 65 per cent of the cost of equivalent electric engines. This is an economic handicap that electric traction has now overcome by other advantages in order to secure an equal position. From an economic standpoint, the greatest advantage of the electric locomotive is its freedom from the need of frequent construction and repairs which permit of materially longer engine divisions, for continuous road service, and larger annual mileage. Maintenance cost per engine-ton-mile for an electric locomotive is of the order of perhaps 30 per cent that for a steam locomotive.

From the new standpoint of conserving natural resources the saving of fuel with electric operation is important, as it may reach 50 per cent when steam locomotives are compared with a highly efficient central steam-electric generating station supply. In 1925 25 per cent of the total bituminous coal produced in the country was used by the railroads. A saving in the transportation of half the amount used by railroads would have totaled 43,000,000 tons, or 825,000 average carloads.

The energy returned by regenerative braking of a freight train over a route with mountain grades may be from 10 to 20 per cent of the total energy obtained from the contact wire.

Certain conditions are fundamentally favorable to electrification, and this is notably true in situations where freight and passenger traffic of widely diverse speed is approaching the limit of plant capacity with steam operation and existing steam motive power. The movement of heavy slow trains at advancing speed may be accomplished more readily by using electric motive power than by using steam motive power.

Some of the main lines of railroads in the eastern part of the United States have reached such a state of traffic density that relief is needed. This may be secured by an additional track or tracks to the route, or by building an alternative route. Either improvement is likely to be very costly in a well-populated region. Relief may also be secured by consolidating trains into longer units and reducing the disparity of operating time of the different classes of trains in the freight and passenger service. This latter release may be gained by means of electrification, using multiple cab locomotives with unit control for freight trains and the heavier passenger trains, single cab locomotives for intermediate trains, and multiple-unit electric trains for local passenger service.

The complete economic consideration of a contemplated electrification of the railroad which has been and is using steam motive power of good quality is far from a simple matter. A competent engineer can, without difficulty, estimate the new money required to construct the necessary power supply and distribution system and to secure the needed electric motive equipment and can, with a reasonable degree of accuracy, estimate the operating expenses under electric operation for improved conditions for handling the traffic which may be made available by electric motive power. These estimates do not tell the whole story. It is probable that existing steam schedules on any railroad should be radically changed if the benefit of the change from steam operation to electric operation is to be realized.

Cable Improvements Reduce Energy Losses

By William A. Del Mar
Habirshaw Cable & Wire Corporation

LITTLE thought is given to the cost of the energy loss which in a new cable usually averages between 1/10 and 15/100 of a watt per foot of cable. The cost of the energy loss per mile

*The Goal of Research**

By Willis R. Whitney
Vice-President and Director of Research Laboratory, General Electric Company

THERE is some danger of overpopularizing industrial research and also of overdoing the use of the term. The result of attracting special attention to research may be to suggest something essentially false, like a general panacea for work or a cure for all economic ills, and so induce unprepared people to undertake ill-advised work. The excessive demand for scientists in very recent years has indicated such misconceptions.

We overdo the use of the term "industrial research" when we apply it, for example, to the testing of materials in order to check up on specifications. That it is not. It is something designed to discover untested materials and processes, to bring about better use of old materials, to reveal new wants, create new desires and actually predetermine new needs. One might even say that its aim is to perpetuate dissatisfaction with things as they have been and insure open ways to unlimited change. It is continually digging out of the universe new things recognized easily, after the event, as indispensable. One of its aims is to anticipate and predetermine our wishes, so that established manufacturers may, by improving, continue to grow.

**Excerpt from paper presented at the World Engineering Congress in Tokyo*

of cable will be of the order of $18.50 to $27.80 per annum with (increment) power cost of 0.4 cent per kilowatt-hour. As the cable ages the loss in the dielectric generally increases, especially if petrolatum is used for an impregnating compound. The loss in such cables may increase tenfold in five years, in which case the annual cost of the losses may amount to between $185 and $258 per mile of cable, an item of some importance.

The recognized tendency of the day is toward the use of thinner compounds containing a considerable amount of resin, a combination which has been found to give a relatively permanent dielectric loss and satisfactory results.

Initiative Encouraged

By W. H. Blood, Jr.
Vice-President Stone & Webster Engineering Corporation

PUBLIC ownership and operation has been cast aside in the United States as uneconomical and undesirable, for, with few exceptions, experience has demonstrated this to be a fact. Regulation by state commissions rather than by local boards or by municipalities has been found most satisfactory, since under attempted local regulation politics and personalities cannot be eliminated. A commission which acts solely for the people as a prosecuting attorney, barking at the heels of capital by reducing rates to the breaking point, does the community as great an injustice as one which is the slave of the utility and signs on the dotted line any request or order which is presented to it. Fortunately most of our commissions act in a judicial capacity.

The outstanding criticism of public utility regulation today comes from that part of the public, aided and abetted by certain types of newspapers and politicians, which holds to the theory that any decision adverse to its own wishes is wrong. They have been taught to believe, without any knowledge of the facts, that rates are always too high and that the utilities are making inordinate profits.

In 21 states the commissions are elected by the people and in 26 they are appointed. The appointment rather than the election of both judges and of public service commissioners tends to secure better men and fairer decisions. In many states salaries of commissioners are inadequate. These should be comparable with those of the utility executives. Tenure of office is frequently short. Permanency in the regulative body is desirable and provision for longer terms, perhaps ten years, should be made, or indefinitely at the discretion of the governor and "during good behavior." The so-called people's counsel plan, under which one person is expected to represent the public after the fashion of a prosecuting attorney, is intolerable. It creates a divided house and causes the agents of the commission to become prejudiced.

Few Court Appeals Required

In general, the decisions of the commissions are just and but a small number are taken to the courts for review. Because of the fundamental principles involved and on account of the time and expense entailed, the impression arises that commission regulation is not altogether successful. Thousands of cases are settled informally every year of which the general public has no conception. Court reviews are frequently desirable in establishing precedents, and generally these show that the commission has acted fairly and wisely.

Federal regulation to supersede the state regulation of local utilities has a few advocates, but no general support. State regulation has largely passed the experimental stage and is widely regarded as successful. President Hoover has said that regulation should be extended by the federal government "only when individual states are without power to protect their citizens through their own effort." Closer uniformity in regulation, however, is desirable, and there are hopeful signs along this direction in that an act suitable for uniform adoption has been approved by all the national organizations competent to pass upon its provisions. Uniformity in regulation would make for economy and would enhance the marketability of securities without in any way restricting the rights of the public or of the companies.

Based on Judgment

No formula has ever been devised for fixing values, but the United States Supreme Court has laid down certain guiding principles which commissions must recognize. At present it is believed that the highest court has said that the most important factor to consider in determining "fair value" is the "present cost to reproduce the property new, less observed depreciation." Other factors, such as original cost, present and future cost tendencies, etc., should also be weighed. The commission is supposed to interpret the market demands for utility securities and to allow such a rate of return as will attract capital for additions and service needs. Under regulation recognition of efficiency in operation and initiative is lacking, and this can and should be corrected. One method proposed is by automatic sliding scales in which dividends and charges for service are inter-related. It would be helpful if our higher courts could establish some guiding instructions or be a little more explicit as to how to arrive at value. It is also essential that means be more generally provided for shortening the time lag in cases where rates have to be raised, by permitting increases as soon as needed, accompanied by the setting aside of a suitable fund for reimbursing customers in case the rate is determined to be too high.

Small Need of Holding Company Regulation

The necessity for holding company regulation is apparent only when state regulation is inadequate. If the operating company receives only a fair return on the fair value, it should be no concern of the public what it does with this return. The power of regulation rests where it should, and if rightly applied, calls for no additional agency or super-regulation. Federal regulation seems to be unnecessary and undesirable. It has been claimed unconstitutional; at any rate, it would open the door to conflicts in authority and might discourage development. If it is found that the state commissions are unable to cope with the situation under the present laws, their powers should be expanded so that they can get from the utilities which they supervise adequate service at reasonable rates. If holding companies are to be further regulated, it would seem rational to have this effected through national banking and investment laws and made applicable to holding companies of all kinds and not specifically to utility holding companies.

In the United States the general sentiment is that the government should confine itself strictly to the duties of governing and that business and industry should be left to the initiation and execution of individuals. The government can properly regulate business and industry wherever it is necessary to do so for the public good, but its carrrying on of commercial activities should be held at a minimum. Politics cannot be eliminated under government operation, and, on the other hand, business questions must be decided on their merits without political interference.

Progress Assured Through International Co-operation

By John Hays Hammond

UNTIL quite recently the engineer did not command the influential position he now deservedly holds in public estimation. In America, for example, the engineer who was engaged in developing the resources of countries which were economically backward was stigmatized by provincial politicians as an advance agent of unprincipled exploiters. The engineer is now universally recognized as a benefactor of the world at large. He is destined to become a real "ambassador of good-will" when there is a broader realization that beneficent deeds are more convincing than mere gestures of professed amity.

Nothing is more false than the more or less prevailing belief that imagination is useful only to the poet, artist or

philosopher and should be suppressed by the practical man as dangerous. The engineer, practical as he is, must at the same time be as much of a dreamer as any of these if his work is of any magnitude. He must be able to see a need and its remedy before the need arises and forestall difficulties before they appear.

In our country it has only recently been recognized that the qualities that make an engineer of outstanding reputation are those peculiarly suited to the administration of governmental affairs.

Advocates Simpler Voltage Ratings

By R. E. Argersinger
Chief Electrical Engineer Stone & Webster Engineering Corporation, Boston, Mass.

THE use of "nominal" and "rated" system voltages admits the practice of using apparatus of different ratings on the same system and may lead to situations in energy supply or interconnection under which units cannot be paralleled or interchanged, or systems tied together without readjustment or the use of auxiliary apparatus. Such a program to a great extent defeats its own purpose.

All similar apparatus connected to a system of given voltage should have the same rating provided that rating is flexible enough to meet local conditions of apparatus usage. There should be only one voltage rating for the system in place of the "nominal" and "rated" voltages, and transformers and circuit breakers should be rated at the system voltage. The system voltage determined should be maintained at all stations, giving constant voltage transmission. This should enable power interchange at will without annoying customers by voltage disturbances. Transformer taps could be reduced in number, as well as the amount of exciting current carried and the overheating of transformers through overexcitation. The capacity of voltage regulators could be materially lessened.

In most cases the normal drop on heavy-duty transmission lines does not exceed 10 per cent and transformers having a 20 per cent tap range should be generally suitable. This would eliminate the design of different classes of transformers now referred to as "step-up," "general purpose" and "reversible" units, since all would be reversible and interchangeable. Material reduction in transformer costs, shorter delivery schedules and probably a better product should result. For new work only "preferred" voltage ratings* should be used.

Quantity Production of Circuit Breakers

Since circuit breakers can always be used at voltages below their ratings, immediate standardization of breakers only for "preferred" voltages should be feasible (220 kv., 132 kv., 66 kv., 33 kv., 13.2 kv., and a few lower ratings). Many present ratings of breakers are the result of variation in rupturing capacity, indoor or outdoor service, altitude conditions, etc. Breakers are practically "custom made," with resulting higher prices and longer deliveries than if each size of breaker were built in comparatively large quantities and carried in stock. Manufacturers can only be expected to adopt the latter program when ratings called for are few.

When rated at the "preferred" voltage, breakers should be tested at 2.5 times normal plus 2,000 instead of 2.25 times normal plus 2,000 volts. This increase would compensate for operation at high transformer taps or overexcitation, besides improving the factor of safety against surge voltages, which appear to be running higher than was expected when the present test rules were adopted.

For the two higher voltages, one rupturing capacity rating for each should suffice. For the lower voltages perhaps two each, medium and high, might be necessary, but with such a program of voltage and rupturing capacity ratings put into practice manufacturing costs and prices should be lowered.

Closer Voltage Regulation Needed

Since there is a strong trend toward the use of higher voltages in distribution systems, consideration should be given to the use of 550 instead of 440-volt motors, and efforts should be made looking toward the adoption of 125 volts as the preferred appliance voltage. Closer regulation of transmission line voltage is important. Main lines should probably be designed with lower impedance, heavier insulation and devices provided to limit voltage stresses from atmospheric disturbance. With such lines supplied through circuit breakers opening at the first zero point of a short-circuit wave and equipped with regulators which will quickly restore normal voltage, it will be possible under emergency conditions safely to load lines close to the limit of their steady state carrying capacity. Reactors on distribution circuits at the station are useful.

High-Speed Breakers Essential

Present breakers with their operating relays require from 20 to 60 cycles to open a 60-cycle circuit. To reduce this to a maximum of ½ cycle is a major undertaking which must be faced if important load centers are to be supplied satisfactorily over transmission lines. The response from voltage regulators and exciters must also be made faster or timed for the immediate suppression of fluctuations.

Waste of energy in transmission and distribution is still relatively great. Two things are necessary: (1) To develop means of holding constant frequency at any plant, and (2) methods of establishing absolutely the same frequency in all plants. Better automatic control than 1/20 cycle from normal is a possibility. Some use of space radio signals sent from an observatory source of standard time looks promising. Wire transmission of synchronized signals between plants for governor actuation from a common controller has also been proposed, and the use of carrier current appears to have a place, though it is dependent upon the integrity of transmission lines. Apparatus cost, operating expense and service improvements are all intertwined with better voltage and frequency control.

**Referring to those listed as a result of A.I.E.E. committee work.*

Satisfactory Lighting vs. Freedom from Annoyance

By John W. Lieb
Vice-President New York Edison Company

IT IS quite conceivable that it is often worth considerably more than a small saving in the cost of light to double or even treble the life of lamps in order to avoid the annoyance and inconvenience of making frequent replacements under some service conditions. Other things being equal, the inconvenience and nuisance factor would be high in the case of lamps failing after a too short period of service, and relatively low in the case of long life lamps. . . . The actual importance to be assigned to the annoyance and nuisance element depends on many variables. . . . For example, in a hypothetical residential installation of 30 50-watt lamps, if the lamps were operated at an efficiency to produce light at minimum cost under prevailing conditions of lamp price and quality, and at energy rates in the United States, it would be necessary on the average to replace some one lamp every 30 days, while on irregular replacements they sometimes occur at much shorter intervals. If the total cost of lighting were permitted to be increased by about 6 per cent, it would be necessary to replace a lamp on an average of only 40-day intervals. This hypothetical case was presented to a number of individuals for consideration and the choice of the more expensive installation was almost unanimous because of the much greater convenience and freedom from renewals.

Remains of Tokyo Papers Burned in Airplane Fire

N. Y. 167-1
INQUIRY SECTION

United States Post Office
NEW YORK, N. Y.
NOTICE

The piece of mail herewith was damaged through an airplane wreck which occurred at 2.15 AM November 6, 1929, near Ringtown, Pennsylvania.

The damage, whilst regretted, was unavoidable, and the irregularity is under investigation by the proper authorities.

J. J. Kiely, Postmaster

IN THE early hours of the morning on November 6, one of the transcontinental airplanes caught fire in midair. The courageous pilot, thinking of his duties before self, threw overboard several mail sacks. Then, when the plane was only about 1,000 ft. above ground, he took a chance of parachuting to safety. He landed without serious injury and proceeded to try to save the mail remaining in the plane.

Shown herewith is the remains of a letter which was on its way to the ELECTRICAL WORLD from San Francisco conveying late information regarding some papers presented at the Tokyo World Engineering Congress, covered in this issue.

220-Kv. Transmission Lines Show Reliability

By J. P. JOLLYMAN and E. R. STAUFFACHER
Pacific Gas & Electric Company and Southern California Edison Company, Respectively

PERFORMANCE of 220-kv. transmission systems in America has shown them to be a great success. Design and operating problems have been met satisfactorily and 220-kv. transmission is showing a reliability equal to that of lower voltage systems. No difficulties have been encountered that are not found in lower-voltage systems and no radically different devices have been found necessary. Increased loads made possible by the higher voltage have approached the limit of synchronous stability of some of the longer lines. This situation has led to intensive study of the stability problem, and although much is still to be desired, nevertheless progress has been made and a better understanding of this subject now exists.

In reviewing problems of design encountered when 220-kv. transmission was first proposed six major problems had to be solved, including insulation, corona loss, high charging current, protection and switching, system stability and lightning. Of these, switching, stability and lightning still remain as outstanding problems requiring further study and research.

Development of suitable and rugged bushings and satisfactory operating mechanisms, increasing the length of stroke and employment of larger and more rugged tanks have resulted in an oil circuit breaker which is giving quite satisfactory performance. Interrupting capacities of breakers have steadily increased until the latest 220-kv. switches have a rating of 2,500,000 to 3,000,000 kva. However, it appears that system requirements may demand a 30 to 40 per cent increase over this capacity. Apparently the oil circuit breaker in its present form has just about reached its highest development and yet it appears to be the weakest link in the high-tension transmission system. The outlook for any decided progress along lines of past development is rather discouraging, and if larger short-circuit currents are to be interrupted in a period of five cycles or less, development must proceed along radically different lines. Recent announcements of experimental devices for breaking an arc by means other than smothering it in oil are viewed as holding much promise.

Stability tests conducted on one of the California 220-kv. systems shed much light on this important problem. Engineers have concentrated on the problem and as a result generator design has been changed and systems of high speed field excitation have been developed, but it is generally agreed that higher opening speed of oil circuit breakers is the one great need. The extent to which a disturbance may become system-wide depends largely upon how quickly the trouble can be isolated and operating engineers are asking for a breaker that will open a fault current in one-half second or less. With present equipment, however, this is not attainable.

When 220-kv. systems were first considered it was thought they might be nearly immune to the effects of lightning. However, operating records show that 220-kv. systems are not entirely free from the effects of lightning, although undoubtedly they are superior in this respect to lower voltage systems. On account of their high first cost, lightning arresters for 220 kv. have not been used extensively. As on lower voltage systems, the overhead ground wire appears to offer the best solution to the lightning problem, although many mechanical problems arising from the use of overhead ground wires remain to be solved.

Rail Electrifications Show High Economies

By A. I. TOTTEN
General Electric Company

ANALYSIS of railroad electrification policies and operating results and a careful consideration of engineering developments and trends indicate:

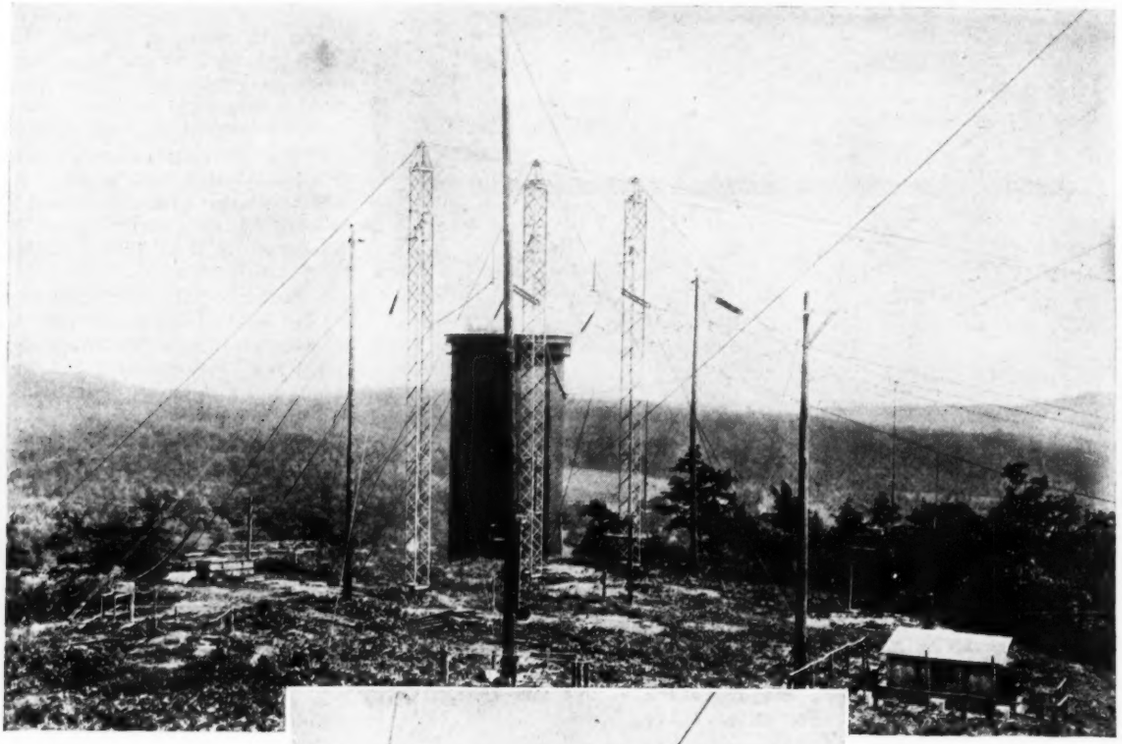
First—That the steam locomotive will predominate for many years.

Second—That the Diesel oil-electric locomotive will be used in increasing quantities.

Third—That the turbine locomotive is still in the experimental stage and that no figures are available to justify its over-all economic position.

Fourth—That as traffic densities on trunk lines and congestion in terminals and yards continue to increase the economic advantages of electric traction will necessitate the greater use of this form of motive power.

Actual Lightning Measured



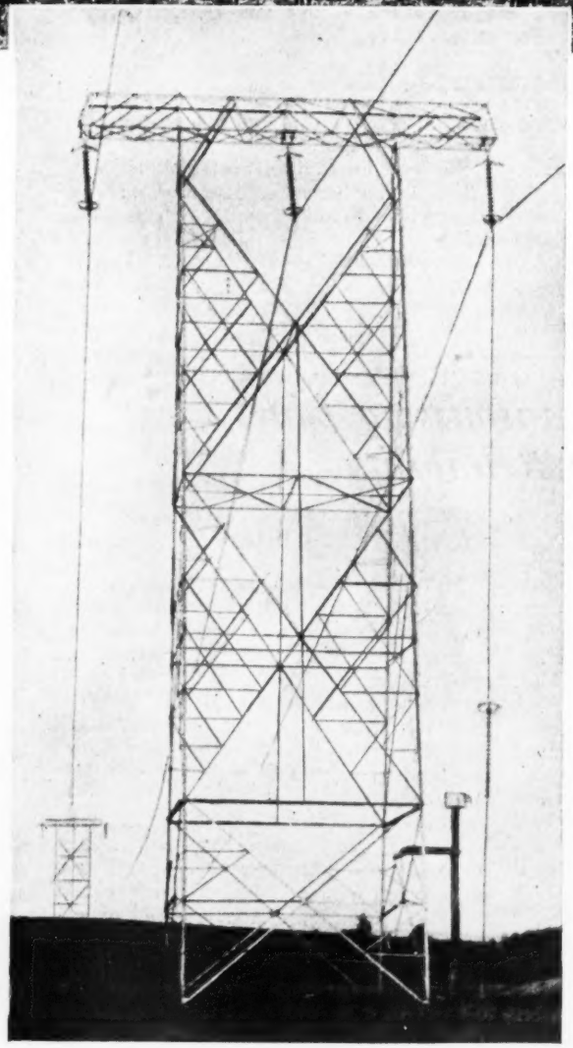
Lightning Laboratory at Wallenpaupack

110-ft. and 75-ft. poles support 100-50-25-12½-ft. antenna with a ground wire.

BEFORE lightning can be handled properly it is necessary to secure knowledge of actual lightning strokes. Knowledge of the magnitude of the waves, the steepness of the waves, the time duration of the waves and data on the effect of induced and direct strokes must be had. Several researches are being conducted in the field on actual lines and the accompanying illustrations show typical research scenes and data of the General Electric Company in co-operation with engineers of the Pennsylvania Power & Light Company, the American Gas & Electric Company and the Ohio Power Company.

It is necessary to take many records of lightning disturbances before conclusions can be made or a determination can be had of the preponderant kind of stroke to be expected. All lightning strokes are not alike in characteristics and effects and one limitation of research work on actual lines is the fact that lightning voltages reach magnitudes that cause line flashovers and, after the flashover, the surge recorded is a line surge with its characteristics determined by the circuit constants.

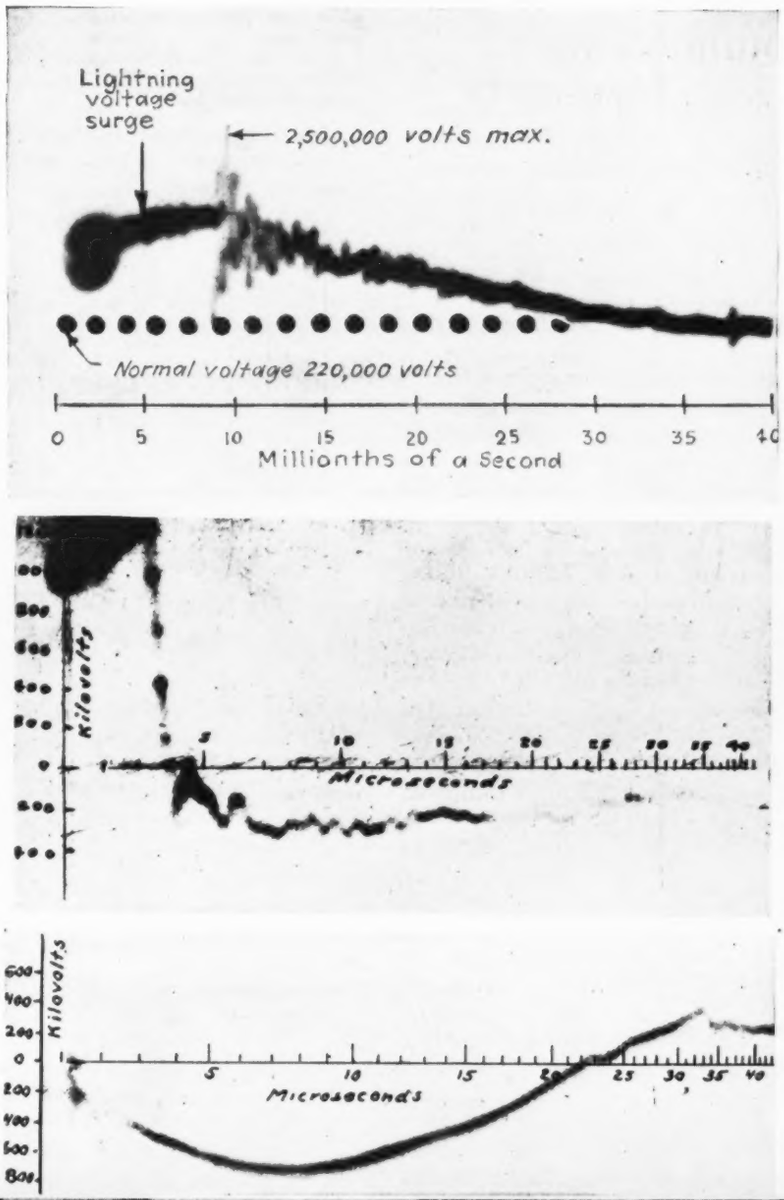
Research work on the 220,000-volt lines at Wallenpaupack, Pa., was started last year and several records have been obtained this season. Other records have been obtained on the American Gas & Electric and Ohio Power Company systems in Ohio. In the 1928 record it was found that the lightning voltage rose to its crest value



Lightning Surge Voltage Recorder Installed on the 220,000-Volt Line of the Pennsylvania Power & Light Company

Actual Oscillograms of Lightning

Top—A stroke on the Wallenpaupack line that caused an arc-over to the adjoining wire. Center—Lightning record on the same line this year showing effect of arc-over on the same wire. Line flashed to ground and changed voltage from negative to positive on the record. Bottom—A positive surge induced by lightning.

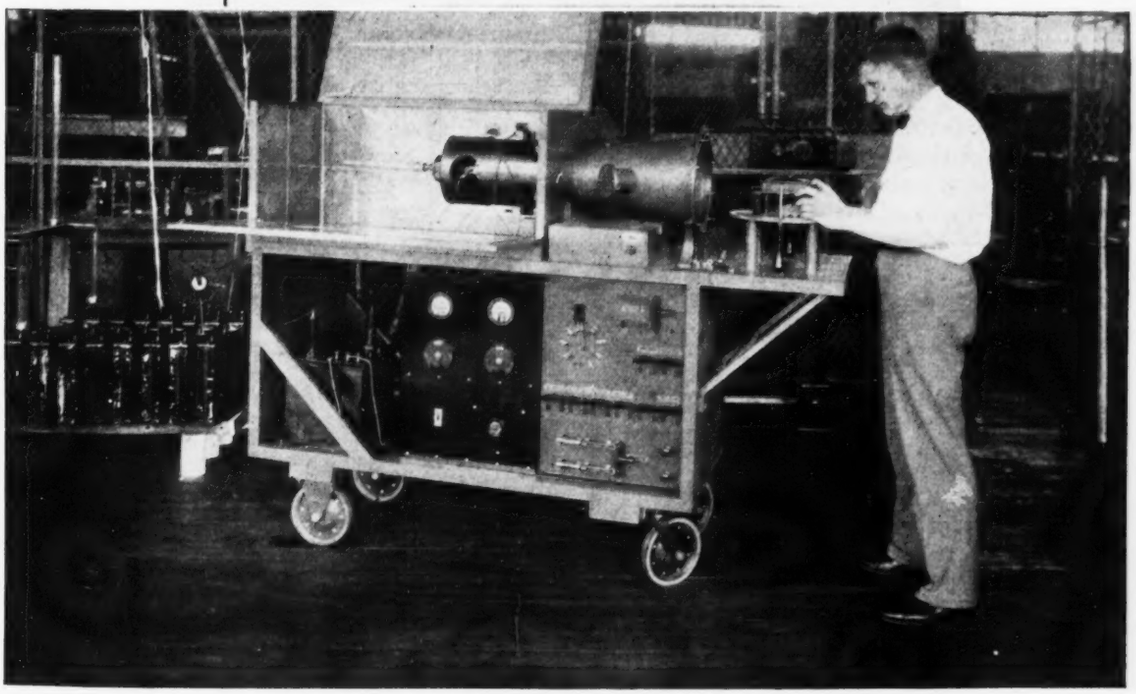


of 2,500,000 volts in 8 microseconds, dropped to half that value in 9 microseconds and was at normal line value in 35 microseconds.

Each record obtained this year tells an interesting story, but two are of particular interest. One was similar to that obtained last year except that arc-over of the insulators occurred on the wire to which the oscillograph was connected. This connected the line to ground and thereby allowed the lightning surge to reduce from a high negative value to a lower positive voltage immediately. In a second record a stroke of lightning induced a positive surge in a transmission line and is notable for being a smooth wave without superimposed oscillations.

It is expected that a large number of oscillograms will be available at the end of this season, but factors such as the variable nature of the strokes, the limited insulation values of lines to lightning and the infrequent nature and location of storms make it an expensive and difficult task to take lightning records in the field. The final results can be counted upon, but the time element is indeterminate.

Portable Cathode Ray Oscillograph for Field Studies



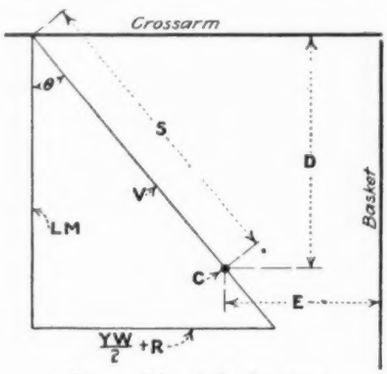
Maximum Swing of Suspension Insulators

An analytical study and recommendation to minimize flashovers and interruptions due to improper clearances

By N. L. Dolph
Electrical Department, Stevens & Wood, Inc.

THE deflection of suspension insulator strings from a vertical position ordinarily receives scant attention in designing a transmission line. This may result in inadequate provision for clearance to tower members, where unusually short spans occur at small angles and at towers which are lower than adjacent towers in the line.

Such conditions may result in line failures during storms of such a character that the cause is attributed to lightning. Decreased clearance during storms temporarily reduces the insulation of the line. This may result in flashover from induced potentials much lower than the normal insulation value of the line.



Graphical Solution of Clearance

Vectors L M and $\frac{YW}{2} + R$ plotted to scale determine angle of insulator deflection ϕ. Length of insulator string S plotted to scale along resultant vector V locates conductor C. The clearances D and E to tower members may be scaled.

In some cases lack of proper clearance at such towers has been apparent when the conductors were installed. This is usually remedied by attaching weights to the conductor clamps.

In other cases inadequate clearances exist only under conditions of unusual transverse load due to high winds. This can be predicted by investigating the forces acting on the insulator strings.

Whether or not hanger brackets are required is usually determined for the line, as a whole, by assuming that the maximum deflection of insulator strings from vertical will be the angle of resultant load for the conductor to be used. This is determined for an assumed maximum condition such as N.E.L.A. class "B" loading. The use of hanger brackets is commonly specified for angles within a given range, such as 5 deg. to 15 deg.

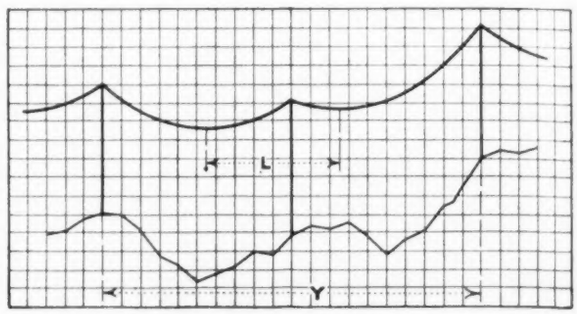
These preliminary calculations are necessarily based on specific assumptions as to span length and elevation of conductor supports. They are correct for the conditions assumed only.

Neglecting the weight of insulators and hardware, the deflection depends on the following factors for any given condition of conductor loading:

1. The vertical component of load, determined from the length in feet of conductor between low points in adjacent spans, multiplied by the weight per foot.
2. The horizontal component of load, determined from the wind load per foot, multiplied by one-half the sum of the adjacent span lengths in feet.
3. The horizontal component of load resultant from tension in the conductor, when there is an angle in the line at the tower under consideration.

Determination of the approximate deflection of insulator strings on a tower may be greatly facilitated by graphical methods.

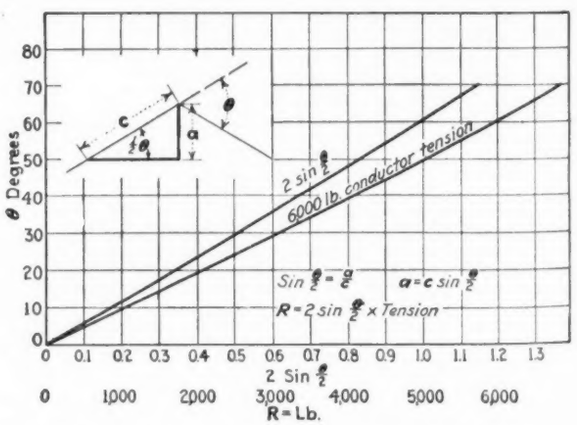
The low point in each adjacent span may be located on the line profile drawing, by means of a template, and the distance between low points scaled. The sum of adjacent span lengths may also be scaled from the profile. The horizontal component due to an angle in the line may be conveniently read from a curve plotted from a number of calculated values. The horizontal force acting on the insulator string will be $\frac{YW}{2} + R$ and the vertical force LM where



Distances L and Y May Be Scaled from Line Profile

Y = The sum of adjacent span lengths in feet.
W = Transverse load in pounds per foot of conductor, due to wind.
R = Resultant horizontal force in pounds, due to conductor tension and angle in the line.
L = Length of conductor between adjacent low points in feet, as scaled from the profile.
M = Weight in pounds per foot of conductor and ice.

The horizontal and vertical force components may then be plotted, as vectors, to scale and the resultant vector determines the angle of deflection of the insulator string. The length of the insulator string laid out to scale along this resultant vector locates the conductor. If arcing rings are to be used, the location of the ring.



Resultant Transverse Load Due to Conductor Tension at Angle

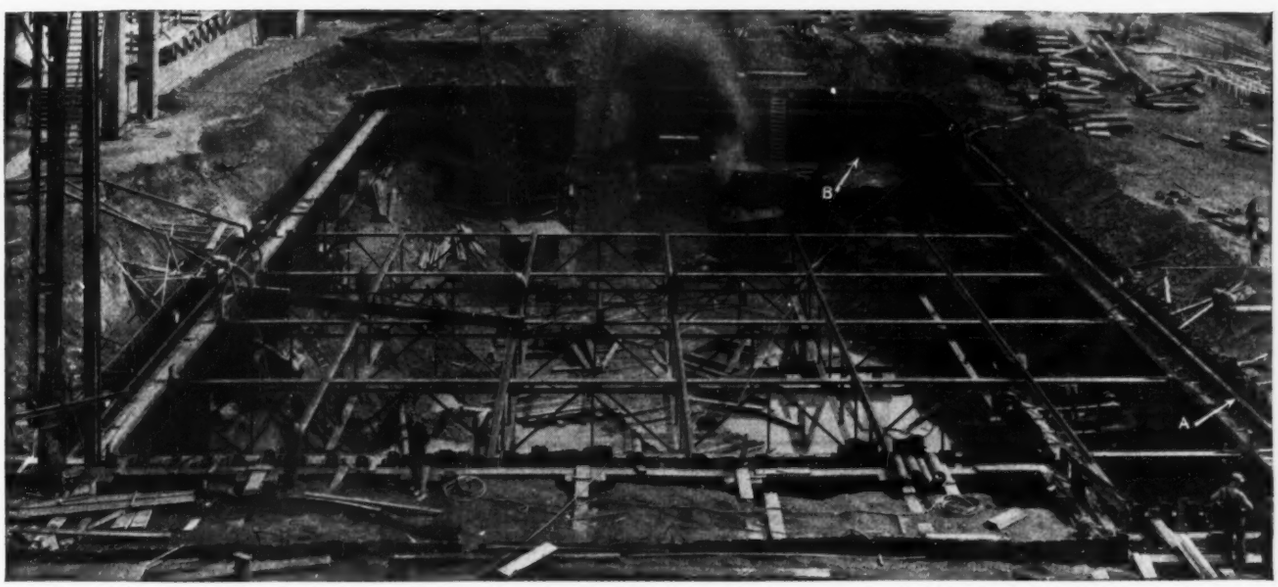
relative to the conductor, should be laid out to scale. The vertical clearance under the crossarm may then be scaled to the conductor or arcing ring.

Whether or not hanger brackets are required on towers where no angle in the line occurs may be quickly checked from the ratio Y/L as scaled from the profile drawing. A preliminary calculation should be made to determine the maximum ratio allowable, without hanger brackets. If a standard length of hanger bracket is to be used, a similar preliminary calculation will determine the maximum value of this ratio for which this hanger bracket may be used to obtain the required clearance.

To illustrate the application to tangent towers, assume a 132-kv. line designed for 300,000-circ.mil copper conductors. For class "B" loading conditions the load per foot of conductor is 1,629 lb. vertical and 1.087 lb. horizontal. Assuming a minimum required clearance to the crossarm of 3.5 ft., and an insulator string 5.5 ft. long, the maximum permissible insulator string deflection without hanger brackets is 50 deg. 30 ft. This corresponds to a ratio $Y/L = 2.51$. With an 18-in. hanger bracket the maximum permissible deflection is 68 deg. 45 ft., which corresponds to a ratio $Y/L = 8.07$. If, at any location, the value of Y/L is 2.51, or less, hanger brackets are not required. If Y/L is greater than 2.51 and less than 8.07, the standard 18-in. hanger bracket should be used.

It should be noted that this method does not follow a rigid mathematical analysis. It is, however, sufficiently accurate for all practical purposes.

Steel Bracing and Well Points Aided Excavation



Steel Bracing for Sheet Piling Permitted Economies in Excavation
A, discharge header for drainage system; B, suction header.

RATHER unusual construction methods were employed in preparing for the foundation of the James H. Reed station of the Duquesne Light Company, Pittsburgh. Owing to the proximity of the Ohio River (320 ft.), the nature of the soil and the fact that the excavation had to extend 11 ft. below the normal river level, particular attention had to be given to the shoring and drainage.

To retain the earth in position around the excavation sheet piling braced by the steel framework shown was used. Drainage was afforded by a total of 200 well points spaced regularly around the perimeter of the excavation and connected with a suction manifold and discharge header.

First the site was excavated to a depth of 8 ft. and 40-ft. interlocking sheet piling was driven. Then about 12 ft. of earth was removed inside the piling. At this level another cut of about 13 ft. was made, but a sufficiently wide ledge of undisturbed earth was left next to the piling so it would temporarily retain the earth outside by cantilever effect. After this cut was well along the steel bracing shown was installed

The large shovel shown in the excavation on the right removed a large portion of earth bracing as it backed away to make room for the steel bracing. Finally, two $\frac{3}{8}$-yd. caterpillar shovels were used under the bracing to complete the excavation to a depth of 38 ft. This left the piling extending 10 ft. below the bottom of the excavation. Trucks were backed down the ramp.

The concrete foundation which was placed just inside the steel bracing was poured while the bracing was still in place and 8x10-in. timbers were wedged between the sides of this concrete and the sheet piling to replace the steel bracing before it was removed.

According to M. R. Sumner, who is general superintendent of construction for the Pittsburgh branch of the Byllesby Engineering & Management Corporation, the drainage system proved very satisfactory. Furthermore, the steel bracing greatly facilitated excavation and resulted in substantial saving over the use of wood bracing. The cost of the steel bracing was equal to or slightly more than the wood bracing, but the clearance and working space under it were much greater and permitted the use of machinery and cost-saving methods.

1,000 Trucks Bring Public Utilit

By O. J. LANGE

General Electric Vehicle Representative Public Service Electric & Gas Company

Starting in 1915 with 150 industrial trucks on lines, about 850 have been added at sales expense equivalent to 4 per cent of gross revenue

THE electric industrial truck first made its appearance in industrial plants in 1912 or 1913. In 1915 there were approximately 150 of these machines in the territory of the Public Service Gas & Electric Company. Today we have more than 1,000 trucks in the territory, consuming approximately 7,500,000 kw.-hr. annually. At 2 cents per kilowatt-hour these trucks would produce an annual revenue of $150,000, and the total revenue received to date would be in the neighborhood of $1,300,000. The total sales promotion expense on the part of the Public Service Electric & Gas Company has been in the neighborhood of $55,000, or slightly more than 4 per cent of the gross revenue.

During the year 1928, 99 trucks were sold in the territory, 62 of which went to present power customers of our company. This equipment has potential power consumption over its useful life of 465,000 kw.-hr., or a gross revenue of $93,000 at 2 cents per kilowatt-hour. This, briefly, is the dollars and cents result of the promotional activity of the electric industrial truck in our territory.

The gross revenue figures, however, do not tell the complete story, for in the final analysis promotional activities should be based on the dollars of net profit per dollar of expenditure, and the type of load which we have secured from this equipment is practically off-peak load and of a most profitable character.

The industrial electric truck, which is rapidly gaining favor as a method of reducing plant handling cost, consumes from 5,000 to 10,000 kw.-hr. annually, depending on the size of the truck and use to which it is put. It is interesting to compare this current consumption with other appliances whose sale is now being promoted by nearly all power companies. The first column in the accompanying table, with the exception of the figure for industrial trucks, has been taken from the N.E.L.A. monthly bulletin, No. 267-2, "Wattage and Operating Cost of Various Electric Appliances."

The second and third columns have been added as a result of the following calculations. By dividing the kilowatt-hour consumption of the different single appliances into 7,500 kw.-hr., we secure in column 2 the number of appliances required to provide an annual power consumption equal to one industrial truck, an interesting comparison.

The third column is the result of a study of the relative profit of peak and off-peak load. A dollar of gross revenue derived from peak power generally carries with it the necessity of an investment of $5 in plant equipment, which at 15 per cent fixed charges would amount to 75 per cent of the dollar secured. If to this is added a 16 per cent generating cost we find only 8 per cent left to cover all overhead and profit. Off-peak power at one-half the cost per kilowatt-hour will show a percentage of profit approximately four times as great due to the omission of all fixed charges with this type of load. We have therefore multiplied the number of appliances shown in column 2 by four to secure the number producing a net profit equivalent to that received from one industrial truck.

Electric industrial	Annual Kw.-Hr. Consumption	No. Required for 7,500 Kw.-Hr.	No. Sales Required for Net Profit Equal to One Industrial Truck
trucks	7,500	1	1
Ranges	1,500	5	20
Refrigerators	864	9	36
Fans	51	147	588
Percolators	41	183	732
Toasters	375	20	80
Washing machines	20	375	1,500
Vacuum cleaners	25	300	1,200
Flatirons	67	112	448

We do not mean to imply in any way from the above that the promotion of these other appliances is not profitable, as their number makes it extremely so. We merely wish to point out the profitableness per unit which is afforded in the electric industrial truck. A comparison might be made with the automobile business, where every one knows the profits accruing from the sale of Fords or Chevrolets, but at the same time the profit per car in selling Cadillacs and Packards warrants the cultivation of the market for the latter type of equipment.

TRUCK LOAD REQUIRES LITTLE SERVICING

We, therefore, conclude that on the basis of net profit per sale the industrial truck is one of the leading power-consuming devices which can be developed by the electric power company. There are certain other factors concerning the promotion of this equipment which should appeal to the commercial executive. Due to the fact that the installation of charging equipment, etc., is made entirely on the secondary side of the customer's transformers there is little installation or service work required on the part of the electric power company. Also, due to the off-peak feature of the load, there is seldom any necessity of increasing the size of the customer's extension or his substation equipment.

From the standpoint of public relations, the industrial truck holds an enviable position, for it seldom saves the customer less than the wages of three to four men, and thus may be the means of saving him an amount equal to or greater than the entire power bill for his plant. If the electric power company has been instrumental in saving its customer such a large amount of money, this will be reflected in the relations between the company and that customer. The industrial truck also provides a

it 150,000 a Year

Nature of Reprint Material Sent Out on Applications of Trucks to Specific Industries

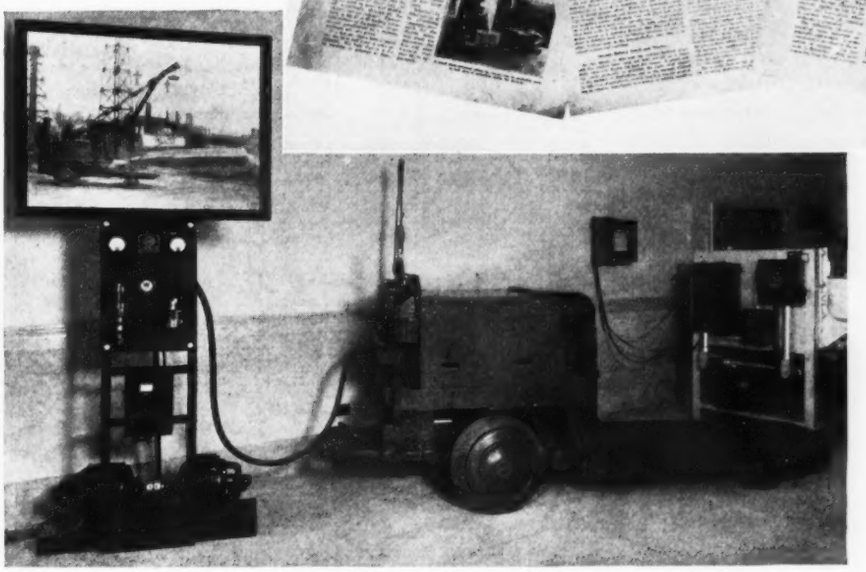


Exhibit of Industrial Trucks and Charging Equipment

visible example of electric service and constantly brings to the attention of its owner the service rendered through the power company. This is not always true in the case of other apparatus, which is scarcely noticed until the electric power bill is presented for payment. In fact, the industrial truck may be said to occupy a position in the industrial field similar to the vacuum cleaner, toaster and refrigerator, which are such great labor-saving appliances in the residential field.

At the time the Public Service Electric & Gas Company started its promotional activities there was no accurate data from which to estimate the potential market for this equipment. A survey, however, has recently been completed through the Society for Electrical Development showing that there is ample opportunity to install this equipment in nearly every industry and in every size and type of plant. Although it is impossible to estimate accurately, it is believed that the potential market is at the present time less than 25 per cent developed. As a result of the survey referred to above, the manufacturers of industrial trucks have combined in a comprehensive market-broadening activity which offers an excellent opportunity for any electric power company to employ an economical method of sales promotion.

The promotional activities of the Public Service Electric & Gas Company may be classified under three main headings: Mail advertising; exhibits and talks, and, third, direct personal cultivation by men trained in the application of this equipment to materials-handling problems. The direct mail campaign has consisted chiefly in blotters, illustrated folders, letters and reprints of magazine articles describing the use and savings of trucks in different industries. The latter type of advertising, in which each plant received an article dealing with the use of trucks in its particular industry, was most productive of inquiries, and one mailing of such resulted eventually in the sale of six trucks. The most important part of the promotional work is, however, that of the special representatives in the electric vehicle department, where two men are employed in the promotion of both street and industrial trucks. These representatives are familiar with all the truck installations in the territory, have made a study of materials and handling methods and are competent to demonstrate the various applications of the truck in a specific plant. These representatives do the initial work and bring the prospect to a point where he

is ready to contact with one or more of the truck company representatives. The selection of the make of truck is left entirely in the hands of the prospect, and our representatives at all times maintain an impartial attitude. Although the following fact cannot be attributed entirely to the efforts of the Public Service Electric & Gas Company, it is interesting to note that the State of New Jersey has the second largest number of industrial trucks per 1,000 inhabitants of any state in the country, being exceeded only by Michigan, with its very large number of trucks used in the automotive industry.

It has been generally noted from government statistics that the number of wage earners in industry is increasing less rapidly than the number of products produced. It is our contention that the industrial truck is doing more than its mite toward increasing the efficiency of production in the industries of the country and especially in New Jersey.

Large or Special Turbo-Generators Recently Placed in Operation

Serial Report of Prime Movers Committee National Electric Light Association—1929

Capacity, Kw.	*Manufacturer	Operating Company	Station	†Type	Speed, R.p.m.	Volts	Steam Conditions—Remarks
165,000	G. E.	Ohio Power Co., Philo, Ohio	Philo	C.C.	1,800	11,000	600 lb.—reheating Highest capacity unit in operation.
160,000	Brown-Boveri	United Electric Light & Power Co., New York, N. Y.	Hell Gate	C.C.	1,800 1,200	13,800	275 lb., 610 deg. F. Highest capacity double C.C. unit in operation
110,000	West.	Brooklyn Edison Co., New York, N. Y.	Hudson Avenue	C.C.	1,800	13,800	400 lb., 706 deg. F.
104,000	West.	Commonwealth Edison Co., Chicago, Ill.	Crawford Avenue	C.C.	1,800	12,800	550 lb.—reheating.
94,000	G. E.	Southern California Edison Co., Los Angeles, Calif.	Long Beach No. 3	T.C.	1,500	16,500	400 lb., 725 deg. F. Highest capacity single-shaft turbine and largest generator in operation.
91,500	G. E.	Commonwealth Edison Co., Chicago, Ill.	Crawford Avenue	C.C.	1,800 1,200	12,000	550 lb.—reheating.
75,000	G. E.	Buffalo General Electric Co., Buffalo, N. Y.	Chas. R. Huntley	S.	1,500	12,000	250 lb., 660 deg. F. Highest capacity single-cylinder type of turbine in operation.
65,000	G. E.	Edison Electric Illuminating Co., Boston, Mass.	Edgar	S.	1,800	14,000	350 lb., 725 deg. F.
60,000	West.	Milwaukee Electric Railways & Light Co., Milwaukee, Wis.	Lakeside	S.	1,800	13,800	290 lb., 700 deg. F.
55,000	G. E	Super Power Company of Illinois, Pekin, Ill.	Pekin	T.C.	1,800	22,000	600 lb.—reheating. First 22,000-volt generator in operation.
50,000	Allis-Chalmers	Public Service Company of Northern Illinois, Waukegan, Ill.	Waukegan	T.C.	1,800	12,000	600 lb., 725 deg. F.
50,000	G. E.	Detroit Edison Co., Detroit, Mich.	Delray Trenton Channel	S.	1,200	12,200	375 lb., 700 deg. F. Five units.
50,000	G. E.	United Electric Light & Power Co., St. Louis, Mo.	Cahokia	S.	1,800	13,800	315 lb., 725 deg. F.
50,000	G. E.	Exeter Power Co., Pittston, Pa.	Stanton	S.	1,800	11,000	600 lb.—reheating.
10,000	West.	Kansas City Power & Light Co., Kansas City, Mo.	Northeast	S.	1,800	13,200	1,200 lb., exhausting against 365 lb. back pressure.
10,000	G. E.	Edison Electric Illuminating Co., Boston, Mass.	Edgar	S.	3,600	14,000	1,200 lb., exhausting to 350 lb. station header
10,000	G. E.	Hartford Electric Light Co., Hartford, Conn.	South Meadow	S.	720	.....	Mercury vapor at turbine, 72 lb., 884 deg. F.
7,700	G. E.	Milwaukee Electric Railways & Light Co., Milwaukee, Wis.	Lakeside	S.	3,600	.....	Operated in compound with 300-lb. condensing turbine.

*G. E.—General Electric Company
West.—Westinghouse Electric & Manufacturing Company.

†S. —Single cylinder.
T.C.—Tandem compound.
C.C.—Cross-compound.

Large or Special Turbo-Generator Units on Order or Under Construction

Serial Report of Prime Movers Committee National Electric Light Association—1929

Capacity, Kw.	*Manufacturer	Company	Station	†Type	Speed, R.p.m.	Volts	Steam Conditions—Remarks
208,000	G. E.	State Line Generating Co., Chicago, Ill.	State Line	C.C.	1,800	22,000	600 lb.—reheating. Highest capacity unit under construction.
165,000	West.	United Electric Light & Power Co., New York, N. Y.	Hell Gate	C.C.	1,800 1,200	13,800	265 lb., 700 deg. F.
160,000	G. E.	New York Edison Co., New York, N. Y.	East River	T.C.	1,500	11,400	275 lb., 700 deg. F. Highest capacity single-shaft turbine under construction. Generator has two separate windings—each of 80,000 kw. capacity.
94,000	G. E.	Southern California Edison Co., Los Angeles, Calif.	Long Beach No. 3	T.C.	1,500	16,500	400 lb., 725 deg. F. Similar to unit recently placed in operation at this station.
75,000	G. E.	Union Electric Light & Power Co., St. Louis, Mo.	Cahokia	S.	1,800	13,800	315 lb., 725 deg. F. Largest 1,800-r.p.m. single-cylinder turbine under construction.
64,000	West.	Northern Indiana Public Service Co., Michigan City, Ind.	Michigan	S.	1,800	22,000	650 lb., 750 deg. F.
63,000	G. E.	Columbia Power Co., Cincinnati, Ohio	Columbia	T.C.	1,800	13,200	600 lb.—reheating. Rebuilding the 45,000-kw. unit.
60,000	West.	Duquesne Light Co., Pittsburgh, Pa.	James H. Reed	S.	1,800	11,500	375 lb., 725 deg. F.
60,000	G. E.	Alabama Power Co., Birmingham, Ala.	Gorgas	S.	1,800	13,800	400 lb., 725 deg. F.
55,000	G. E.	Super Power Company of Illinois, Pekin, Ill.	Pekin	T.C.	1,800	22,000	600 lb.—reheating Similar to unit recently installed at this station.
55,000	West.	Duke Power Co., Spencer, N. C.	River Bend	S.	1,800	13,200	425 lb., 725 deg. F. Two turbines on order.
55,000	G. E.	New Jersey Power & Light Co., Dover, N. J.	Holland	C.C.	3,600 1,800	13,800	1,200 lb.—reheating. Condensing.
53,000	G. E.	American Gas & Electric Co., New York, N. Y.	Deepwater (N. J.)	C.C.	3,600 1,800	11,000	1,200 lb.—reheating. Condensing.
53,000	G. E.	American Power Corp., Philadelphia, Pa.	Deepwater (N. J.)	C.C.	3,600 1,800	11,000	1,200 lb.—reheating. Condensing.
12,500	G. E.	American Gas & Electric Co., New York, N. Y.	Deepwater (N. J.)	S.	3,600	11,000	1,200 lb.—exhausted at 450 lb. Exhaust used for process work.
3,700	Brown-Boveri	.....	.....	S.	3,600	.....	1,400 lb.—exhausting at 360 lb.

*G. E.—General Electric Co.
West.—Westinghouse Electric & Manufacturing Co.

†S. —Single cylinder.
T.C.—Tandem compound.
C.C.—Cross-compound

Natural Gas to Compete with Water Power

Forced marketing of natural gas under California conservation law places new sales burden upon electrical industry. Equivalent of 6,000,000 kw. now going to waste

By Walter C. Heston
Pacific Coast Editor Electrical World

UNDER the administration of a natural gas conservation law passed by the last California Legislature great quantities of gas from oil fields of the state will no longer be permitted to go to waste. As a result a new economic order of affairs seems at hand.

During August 29,000,000,000 cu.ft. of natural gas wasted to atmosphere in California fields. Of a total production of 54,000,000,000 cu.ft. there was sold 7,800,000,000 cu.ft. and 17,000,000,000 cu.ft. was used by the oil companies themselves. The amount of gas wasted is sufficient to operate a power plant of 6,000,000 kw., having a thermal efficiency of 12,000 B.t.u. per kilowatt-hour, at 65 per cent load factor. Two wells alone in the rich Kettleman Hills field are producing 240,000,000 cu.ft. of gas a day, or more than half enough to supply the present gas demands of the whole of California. In terms of steam-electric power this is sufficient gas to operate a 1,500,000-kw. steam plant at 65 per cent load factor.

Gas Must Be Used Under Conservation Law

This wanton waste of gas will not continue, that is certain. All large operators welcome enforcement of the new conservation law because it will serve to limit, if not entirely eliminate, overproduction of oil. On October 19 the Standard Oil Company announced a cut of approximately 50 per cent to be paid operators for crude oil in the flush fields of southern California, Santa Fe Springs, Signal Hill and Seal Beach. Within three days six other major oil companies had announced similar cuts. Thus the oil companies themselves have adopted one of the most potent weapons available to them for curtailing production. It follows that a very large reduction in the wastage of gas will result, since the new prices offered will make it unprofitable for independent operators to produce.

When the present overproduction of 220,000 bbl. per day is eliminated by this and other means gas wastage will have been reduced by approximately half, or to about 15,000,000,000 cu.ft. per month. Some of this excess gas can be utilized to advantage for repressuring depleted fields by forcing it back into the ground. Also, the ultimate recovery of oil from a new field can be increased from the present recovery of from 15 to 20 per cent to a recovery of from 30 to 40 per cent by efficient gas conservation methods. But even by utilizing great volumes of gas in this manner there will still remain large quantities that must be stored or marketed if the provisions of the law are to be observed.

Southern California, where natural gas has been used for years, constitutes a large market, and now natural gas is to be made available also in the San Francisco Bay region. Already the Pacific Gas & Electric Company has completed one pipe line to San Francisco and a second is under construction. The two lines will have a capacity of 250,000,000 cu.ft. of gas a day. With a present output for the entire system of this company of less than 100,000,000 cu.ft. per day, capacity will soon be available for doubling the present gas market. An intensive sales drive to market this gas is already under way. Electric cooking, house heating, water heating and industrial heating in gas territory naturally will feel the effect of this new competition. The theory is held, however, and not without some basis, that additional electric uses and new customers brought about by new industries which will be attracted by cheap natural gas will partially, at least, offset the effect of gas competition, and this view has no little justification.

Electrical Industry Faces a New Price Competition

There is another factor, too, which will tend to mitigate the inroads made by gas. Oil producers, forced to find a sale for their natural gas, will undoubtedly make some very low prices to bulk purchasers at the oil fields. It is conceivable that the price of gas may drop to 1 or 2 cents per thousand cubic feet. Such a price as this, even after the cost of transmission is added, will make available gas at a very low rate for burning in steam-electric stations. The Pacific Gas & Electric Company now utilizes some 30,000,000 cu.ft. of gas a day at its San Francisco and Oakland steam plants, and with the completion of the new 100,000-kw. steam plant now under construction in San Francisco an additional 15,000,000 cu.ft. will be burned. Cheap fuel and high plant efficiency cannot help but be reflected in electric rates and encourage greater use, particularly among existing consumers.

What does all this mean, and what effect will it have on the electrical industry of the state? It means, first, that future power development will be almost exclusively steam, because hydro cannot possibly compete with steam-generating costs under these conditions. It means that Boulder Canyon power, if and when it is available, will enter a highly competitive market, a market being supplied with steam power costing not in excess of 4 mills and probably more like 2 mills. It means that cheap natural gas available in the populous centers of California for cooking, house heating, water heating, building heating, industrial heating and internal combustion engines will bring about a new competitive situation for the electrical industry.

Growth of Industry Will Add to Electric Power Load

However, those interested in electrical development need not become unduly alarmed, because there are some compensating features. While it is true that electric cooking may be somewhat retarded, that electric house heating and water heating may become less popular, that industrial electric heating will become more difficult to sell and that gas engines may come into limited use as competitors of the electric motor, it is equally true that new industries, attracted by cheap natural gas, will be large users of light and power and that increased population will add many new domestic customers to the lines of the power companies. It simply means that electric utilities will have to scratch harder for business than heretofore. They will be faced with a highly competitive situation that will compel them to get out and really sell —a task that an up and coming industry such as the electrical industry does not hesitate to face.

Electric Melting Improves Cast Iron*

By G. L. Simpson
Pittsburgh Electric Furnace Corporation

THE electric furnace just naturally does those things which have been found to give an improved cast iron. Refining can be done to any desired degree; the sulphur and the phosphorus may be reduced and the metal freed from detrimental non-metallic inclusion. The furnace provides for a thorough degasification of the molten iron.

Any desired alloy can be added easily in the electric furnace, without excessive alloy loss and under rigid chemical control. The electric furnace provides the superheat that has been found to have such a distinctly beneficial effect on gray iron. Low carbon irons of higher tensile strength and improved wearing qualities can be made. It is not necessary to restrict the use of scrap metal as in cupola melting.

The first real contribution to the improvement of the quality of gray iron came in this country when Elliot of the Lunkenheimer Company undertook to duplex gray iron from the cupola in an electric furnace, desulphurizing and deoxidizing the material for high-grade valve body castings. Reports show that standard test bars cast from metal as it came from the cupola would show a breaking strength of 2,950 lb. and a deflection of 0.1 in. After treatment in the electric furnace the breaking strength rose to 4,400 lb. and the deflection increased to 0.115 in. Other workers in this field report duplexed gray iron having 3.10 per cent carbon, 1.90 per cent silicon, 0.93 per cent manganese, 0.64 per cent phosphorus, 0.08 per cent sulphur, with a tensile strength of 62,700 lb. per square inch and an elongation of 1.10 per cent. The highest tensile strength, 64,000 lb., recorded for a true cast iron is for a synthetic cast iron produced in the electric furnace.

Facilitates Alloying

It is difficult to control analysis and insure thorough dissemination when alloying iron in the cupola, especially when different analyses are desired in the course of a day's cupola campaign. The electric furnace, however, provides a melting medium in which each batch of metal can be alloyed exactly as desired and the metal held before pouring until this analysis is checked at the laboratory, if desired. The introduction of nickel for the improvement in machinability and soundness; the introduction of chrome to increase resistance to heat, and the various combinations of nickel and chrome that might be used to obtain other desirable physical properties naturally fall within the scope of the electric furnace process. In the making of more complex alloy iron, such as non-magnetic iron, high silicon iron, and the like, there are great possibilities.

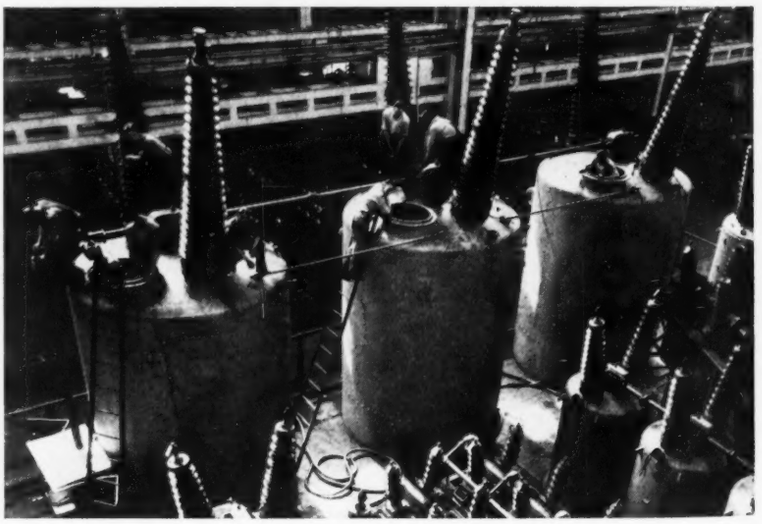
Electric melting permits a more intimate mixture of carbon with the iron and on cooling the carbon separates into more finely divided particles. This fine grain structure is also promoted by the more thorough degasification of the metal obtained in the electric furnace process. The grain size in the average test bar from an electric furnace is noticeably finer than the equivalent analysis made in the cupola. In the electric furnace the carbon content is independent of temperature. Iron of any desired carbon content may be made at any desired temperature, unhampered by the effect of one of these factors on the other.

Electric Furnace Iron Shows High Quality

Certain metallographic arrangements of a given iron and carbon content give greater tensile strength and resistance to wear than others. These are the perlitic structures which are promoted by slow cooling, usually attained by the use of heated molds. But it has been shown that low carbon irons made in the electric furnace and properly superheated before pouring show essentially a perlitic structure without the use of heated molds. For instance, an electric furnace iron containing total carbon, 3 per cent; silicon, 1.5 per cent, and manganese, 0.07 per cent, shows a tensile strength of 43,000-44,000 lb. per square inch. The cause of this is that the higher temperature of the electric furnace iron heats up the molds and thus reduces the rate of cooling through the lower transformation ranges. These high test irons come as the natural results of the electric furnace process, without the use of heated molds or other additional expedients.

*Excerpts from address before recent industrial electric heating conference under auspices of the University of Michigan.

220-Kv. Breakers Have 3,000,000 Kva. Rating



WHAT are said to be the largest oil circuit breakers have recently been completed for the Roseland station of the Public Service Electric & Gas Company, Newark, N. J., by the Westinghouse Electric & Manufacturing Company. This equipment, of the "G" type, is similar, except in size, to the breakers now in use elsewhere and was called for by the demand that high-capacity 220-kv. transmission lines capable of withstanding severe electrical disturbances should have thoroughly adequate protection for station equipment. The continuous current rating is 600 amp. and the published interrupting rating is 8,000 arc-amperes at 220 kv., or 3,000,000 arc-kva.

Boosting Book Value

By C. Maynard Turner
Assistant Chief Engineer Department of Public Works, State of Washington

Artificial raising of price by promoters to issue more securities before unloading not unknown. Frowned on by power industry

THE electrical industry is passing through a cycle of destructive criticism and is the recipient of much adverse publicity. One of the causes for this condition, we know, is the extremely fast rate of growth of the industry and a corresponding expansion of the individual utilities.

The rapid and extensive expansion of the utilities has made necessary the holding, or financing, company. Money must be available at any time and it must be available in larger amounts than the small independent utility of yesterday could obtain. In this modern method of financing the public could see the beginning of an enormous trust; a trust that could not be controlled and would not render public service without high rates and exorbitant profits. Nothing had ever grown so great in such a short time. One of the largest industries in the country had grown to be such within one generation. Anything which is so hard to comprehend is certain to cause criticism.

Artificial Raising of Book Value

As a result of progress within the industry and as a consequence of expert management and careful financing, the electric companies have universally reduced rates until today electric power is competitive with the cheapest form of labor. Even though the majority of the operating companies are controlled by holding companies the criterion of each is "service." The care and expense to which utilities go at the present time to render good service is much greater than in the "good old days." By keeping rates at a minimum, by giving quality "service," as well as selling power and energy, and by maintaining a frank, open policy toward the public, the utilities have managed to counteract, to a certain degree, at least, the original cause for criticism.

This is written to point out and exemplify another major cause for the criticism that has aroused the country within the past few years. It is a practice with which these companies that go to make up the utility industry are not in accord; a policy which the very industry itself has been trying to stamp out. This practice is something which will be found in any field, as it is the child of the minority, and the profiteering "fly-by-night" promoter. It is the raising of book value to meet a predetermined amount in order that more securities may be issued before the promoters unload the property.

As an example: A small independent electric utility named "A" operated in a territory surrounding two or three small towns. The value of the installed fixed capital as carried in the annual report to the state regulatory body was approximately $250,000. As a result of a protest against the rates of the utility the regulatory body found it necessary to make an appraisal and valuation of the property involved. The official value for the tangible and intangible assets of this property was fixed in the neighborhood of $200,000.

After the value of this property had been fixed by the state for rate-making purposes the management sold to a holding company. The annual report filed by the new company very shortly thereafter contained a book value for the same property bordering on $350,000, an increase of approximately $100,000 over the original book value and $150,000 over the value set by the state.

The overnight increase in the stated value of the installed fixed capital of a utility without any change in the physical properties, presumably for the sale of stocks, bonds and other forms of securities by the parent company, is not regarded favorably by the public. In the case cited the interested public already knew the value fixed by the state for rate-making purposes. Such manipulation of records is not the practice of the majority of well-operated utilities, and yet it is the type of operation that has been instrumental in bringing about a federal investigation of the entire industry.

The utility in mind is the type that buys and sells on a rising market, obtains a handsome profit and leaves the purchaser to hold the bag. Because the Department of Public Works of Washington would never allow the utility to file rates of the magnitude necessary to earn a fair return upon any amount other than the value fixed for rate-making purposes, the new owner must hold the property until the ratio of the revenue to the investment increases to a paying amount.

Stock Distribution a Major Function

One of the main activities of this particular holding concern is the selling of stock. Its salesmen saturate the country, selling securities to every one who is willing to make a down payment. The selling of securities by the promoters is out of reach of the public service laws of this state. These corporations, in the first place, are foreign to this state. Moreover, if they were not, the "blue sky" laws exempt public utilities from reporting the issuance of securities to the Secretary of State because such companies are regulated by the State Department of Public Works. However, the fallacy lies in the fact that the public service laws give the department jurisdiction only in so far as rates and service are concerned, leaving unregulated the matter of security issuance.

The particular case mentioned here is not a singular example. Other similar cases could be cited. In fact, the same holding company at a previous time obtained control of, and later purchased, an electric utility named "B." There was considerable agitation for lower rates and some talk of a municipal project. The holding company sold this property at some price unknown to the writer, but surely not less than the enormous sum which it had set up on its books. The crisis of the rate agitation then descended upon the heads of the new operators. This new organization is an operating and not a promoting company and is one that enjoys serving the public, realizing that its business and its "net" will continue to increase only so long as its customers are satisfied and willing to co-operate with it. This utility is a typical cross-section of the operating organizations of this industry. It keeps its overhead at a minimum and practices organized economy throughout its various units.

The value set up on the books of the present owners, of course, was the value carried by its predecessor (approximately $250,000) and the approximate value at which the property was purchased from the promoter. As a result of a hearing the Department of Public Works fixed a value of less than $100,000 as a rate base and reduced the electric rates in this particular community 40 per cent. The utility adopted an inducement form of rate that within a year increased the consumption per customer, increased the company's revenues, and yet brought an enormous decrease in the individual billings of the customers. The company now has the confidence of the people, because it has shown that it is playing the game squarely. The promoting company was unable to do this and its indifferent attitude led to the state investigation.

It is not intended to convey the impression here that some properties are not worth more to the owners or purchasers when consideration is given to possible future growth, development and strategic location. The payment of a greater amount than that allowed for rate-making purposes is often made for good properties. However, the point emphasized here is the hazardous practice of setting up inflated capital values for selfish purposes.

This trouble is not peculiar only to electric utilities operating in this state, as similar instances exist in a few water utilities and, though not to so great an extent, in the telephone industry. Even the ferries and the stage lines have suffered unfavorable publicity due to the action of a few unethical promoters. It is hoped that in due time there will be no more companies of this type controlling utilities within this state. There are now only one or two electric properties so operated. Of the 44 electric utilities at present operating under the jurisdiction of the Department of Public Works it is safe to say that practically all of them are of the conscientious, fair, public-serving type of company operating to give their customers adequate service at reasonable rates.

Industrial Lighting Load Proves Revenue Possibilities

AS THE result of a comprehensive survey of twenty large and small industrial plants of various kinds H. E. Cook* and T. G. Ward of the Detroit Edison Company conclude that: The type of operations has a direct influence upon kilowatt-hour consumption,

Investigation of Light and Power Factors in Twenty Industrial Plants

	Per Cent
Ratio of power to connected load	68.5
Ratio of light to connected load	31.5
Ratio of power demand to total demand	61.0
Ratio of light demand to total demand	39.
Ratio of power demand to power connected load	48.7
Ratio of light demand to light connected load	65.8
Ratio of power kilowatt-hours to total kilowatt-hours	64.3
Ratio of light kilowatt-hours to total kilowatt-hours	35.7
Ratio of power revenue to total revenue	63.0
Ratio of light revenue to total revenue	37.0

architectural features have a direct influence upon kilowatt-hour consumption, light loads are desirable revenue producers, light demands compared to connected

**As reported in sessions of the recent convention of the Illuminating Engineering Society in Philadelphia, Pa.*

Survey Reveals Use Factors of Var

Name	Type of Plant	Area	Watts per Sq.Ft.	Conn. Load Total, Kw.	Conn. Power, Kw.	Conn. Light, Kw.	Demand-Power, Kw.	Demand-Light, Kw.	Demand-Total, Kw.	Kw.-Hr. per Mo. Total	Kw.-Hr. per Mo. Power	Kw.-Hr. per Mo. Light	Revenue per Mo. Total
Briggs Mfg. Co.	Body	1,120,000	2.07	12,079	9,761	2,318	4,713	1,848	6,561	2,288,400	1,813,700	474,700	$29,749.20
Kelvinator	Refrigeration	450,000	2.3	3,015	1,980	1,035	771	361	1,132	417,660	309,360	108,300	5,429.58
Packard Motor Car Co.	Airplane	25,140	2.9	386	311	75	19	60	79	12,040	2,590	9,450	536.10
Crittall Casement Co.	Steel windows	44,800	1.35	220	155	65	40	22	62	10,031	6,971	3,060	340.91
Mazer Cressman Cigar Co.	Cigar manufacturing	24,000	2	149	101	48	65	25	90	21,681	17,789	3,892	546.16
Bernard Swartz	Cigars	40,000	2.07	109	26	83	15	39	54	6,616	1,291	5,325	318.32
John Bornman & Son	Printers	30,500	1.2	159	122	37	36	22.3	58.3	8,000	6,091	1,909	308.18
Morris & Co.	Printers	10,000	2.2 3.1 max.	75	53	22	20.5	12.5	33.0	7,834	3,821	4,013	263.78
Sprague Pub. Co.	Printers	15,000	1.66 3 max.	79	54	25	29.6	14.5	44.1	7,741	5,723	2,018	288.29
Gray Marine Motor Co.	Motor manufacturing	10,676	1.9	39.1	18.7	20.4	11.8	11	22.8	2,683	1,753	930	128.37
Lincoln Mfg. Co.	Electrical fixtures	12,000	1.54	63.5	45	18.5	37	14	51	16,364	12,227	4,147	376.68
Federated Metals Corp.	Salvage metals	10,000	2.5	106	81	25	40	12	52	18,624	14,904	1,860	349.66
F. L. Jacobs Co.	Machine shop	10,800	1.52	109	93	16	41	12	53	18,078	12,655	5,423	395.18
Frederick Coleman & Son.	Machine shop	11,500	2	125	102	23	36.2	22.8	59	12,832	9,882	2,950	362.38
Krutke Bros.	Machine shop	9,300	2.4	48	25	23	22.8	20.0	42.8	7,641	4,514	3,127	247.27
Republic Knitting Mills.	Knitting mill	7,100	2.01	46.9	31.5	15.4	19.8	15	34.8	5,416	3,472	1,944	206.98
Wolf Detroit Envelope Co.	Envelopes	4,800	2	42.6	33	9.6	19.8	6	25.8	4,133	2,968	1,165	169.77
Luers Bros. Mch. Co.	Machine	1,200	2.3	21.5	18.7	2.8	9	2.6	11.6	1,638	1,025	613	51.02
Gagnier Stereotype Co.	Stereotype	8,000	1.7	94	80	14	25	12	37	5,019	4,190	829	159.91
Thos. P. Henry Co.	Printing shop	6,500	2.49	25	9	16	6.1	6.5	12.6	6,373	2,329	4,044	172.36

light loads produce a higher ratio than power demands compared to power connected loads, and power installations are, in general, constant in capacity, whereas lighting affords a variable and hence an opportunity for additional revenue through the increase which is procurable by active solicitation on the part of the serving utility.

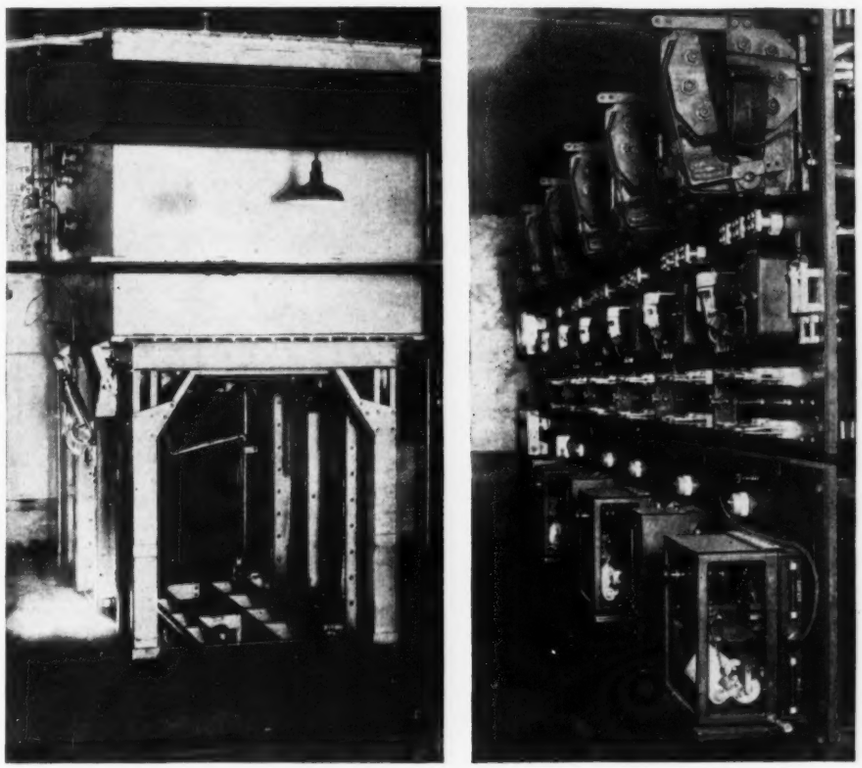
The accompanying tables offer an indication of the data developed and upon which the conclusions are based.

Short-Cycle Malleableizing Improves Product and Saves Time

A NEW short-cycle annealing process for the production of malleable iron castings has been announced by the General Electric Company. With this process it is possible to produce malleable iron in 30 hours or less. Among the advantages encountered by the foundry men are: The elimination of boxes and packing material, reducing labor involved, eliminating hard cleaning if desired and allowing much cleaner operation; reduction of time resulting in less inventory, shorter deliveries and a saving in space and furnace investment; the control of the anneal by varying the cycle, to meet variation in metal composition; and lower cost.

Three electric annealing furnaces are used for this purpose at the Erie plant of the General Electric Company each being rated at 325 kw. and using nickel-chromium ribbon resistor heating elements. The connections are arranged to allow a power input of 52, 170 or 325 kw., as desired. The capacity of the installation is 100 tons of castings per week.

In operation the hard castings, of commercial composition, are packed on the car bottoms with or without iron plates or boxes, depending on the nature of the load. It was found that best results were obtained by stacking the charge directly on the floor of the car.



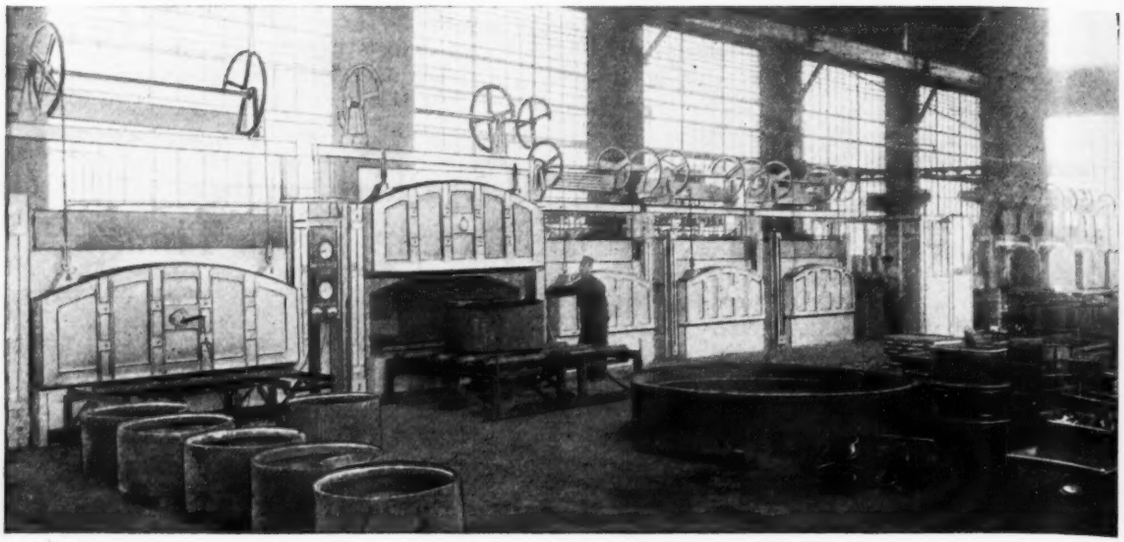
One of Three Furnaces and Control Panel for Short-Cycle Annealing

The charge is then placed in a furnace and heated to a sufficiently high temperature to effect solid solution of free cementite, whereupon the charge is transferred, without removing from the car, to another furnace for cooling. In this furnace the castings are brought to a temperature below 750 deg. C., which is held for approximately four hours, after which the temperature is suddenly lowered a few degrees and maintained at this lower temperature for another four hours, when this step is repeated. The castings are then transferred either to a cooling furnace or into the air, or they may be quenched immediately with increased strength and without brittleness. The average time for a 6-ton anneal is between 28 and 30 hours.

Tests show that the tensile strength, yield point and other characteristics are practically the same with the short-cycle anneal as with the older methods. It was found that the short-cycle malleable iron machines better than the long-cycle product and shows no signs of framing or reversion. Very little skin is found and the castings clean somewhat easier than does the old type of product.

dustrial Plants

Average Rate Power	Average Rate Light	Av. Hrs. Use Light	Ratio Power to Conn. Load, Per Cent	Ratio Light to Conn. Load, Per Cent	Ratio Power Dem. to Total Dem., Per Cent	Ratio Light Dem. to Total Dem., Per Cent	Ratio Power Dem. to Conn. Power, Per Cent	Ratio Light Dem. to Conn. Light, Per Cent	Ratio Power Kw.-Hr. to Total, Per Cent	Ratio Light Kw.-Hr. to Total, Per Cent	Ratio Dem. to Capacity, Per Cent
.013	.013	8.5	80	20	71.8	28.2	48	79.7	79.3	20.7	54.3
.013	.013	10	65.6	34.4	68.2	31.8	38.9	34.8	74	26	37.5
.039	.045	6.05	80.6	19.4	24.1	75.9	6.1	80	21.5	78.5	20.4
.030	.045	5.03	70.4	29.6	64.5	35.5	25.8	33.8	69.4	30.6	28.1
.02	.048	6	67.7	32.3	72.2	27.8	64.3	52.0	82.0	18.0	67.1
.049	.049	5.5	23.9	76.1	27.8	72.2	57.6	47.0	19.5	80.5	49.5
.033	.054	3.1	76.7	23.3	61.7	38.3	29.5	60.8	76.0	23.9	36.6
.035	.032	12.8	70.6	29.4	62.1	37.9	38.6	56.8	48.8	57.2	44
.034	.045	5.3	68	32	67	33	54.8	58	73.9	26.1	55.8
.036	.042	4.5	47.8	52.2	51.7	48.3	62.9	53.8	65.4	34.6	58.3
.022	.025	11.3	70.8	29.2	72.5	27.5	58.2	75.6	74.1	25.9	55.1
.019	.045	4.5	76.4	23.6	76.9	23.1	49.2	48.0	80	20	49
.02	.026	17.3	85.3	14.7	77.4	22.6	44.0	75.0	70.0	30.0	48.6
.021	.05	5.1	81.6	18.4	61.4	38.6	35.4	99	77	23	47.2
.03	.032	5.14	52	48	53.3	46.7	91	87	59	41	89
.033	.047	4.9	67.1	32.9	56.9	43.1	62.8	96.7	64.1	35.9	74.2
.0409	.041	7.5	77.4	22.6	76.8	23.2	60	62.5	71.8	28.2	60
.0297	.0338	9	86.9	13.1	77.6	22.4	48	92	61.9	38.1	53
.025	.062	2.5	85.1	14.9	67.6	32.4	31.2	85	83.4	16.6	39.3
.0248	.0284	20	36	64	48.5	51.5	67.7	40.5	36.5	63.5	50.4



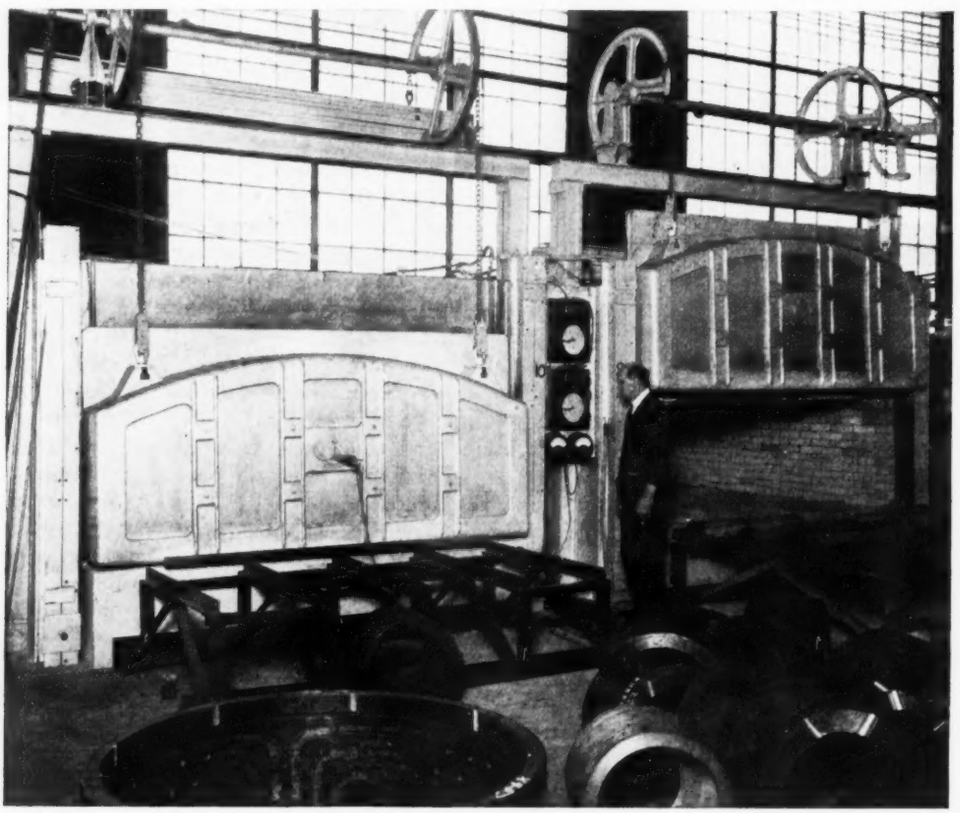
In this battery of nine electric furnaces are treated steam turbo-generator forgings and 4-in. pins for refrigerator units; 1,145 kw. are installed in these furnaces and the weekly consumption is just under 100,000 kw.-hr.

Electrical Manufacturers Can

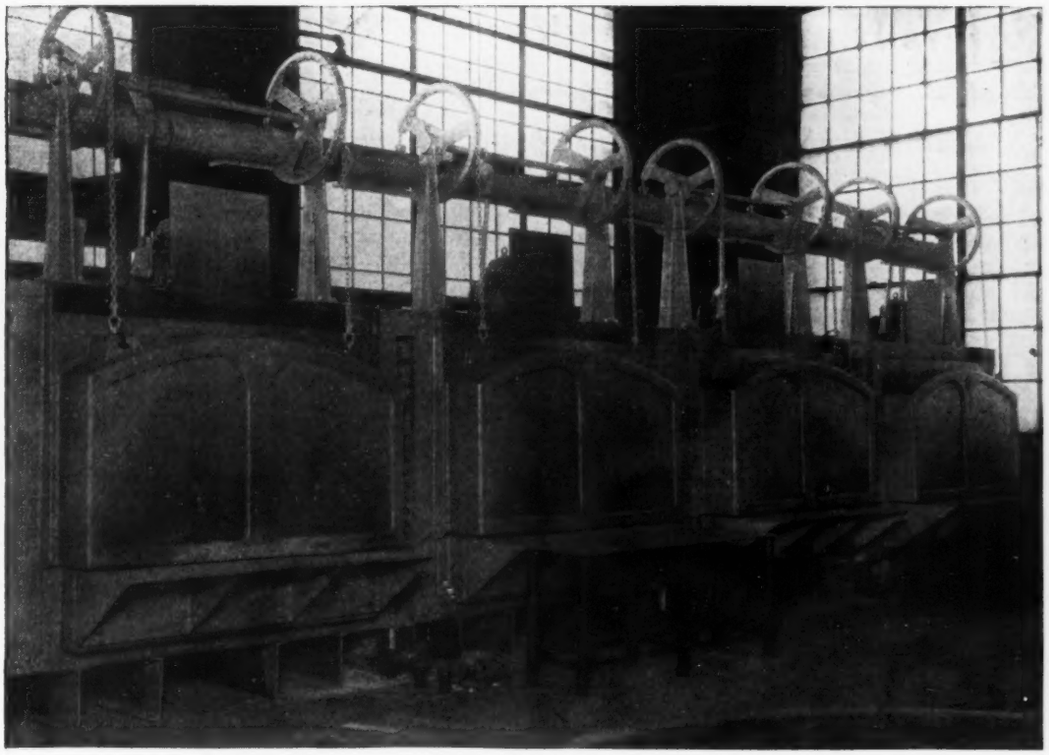
Lead by Example

VARIOUS authorities have estimated that the potential load and energy consumption of industrial applications of electric heat will eventually equal or exceed the corresponding values of the present motor load. On this basis it is not difficult to visualize the amount of electrical and allied equipment which will have to be added to serve this ultimate load. Consequently every manufacturer now engaged in the electrical industry should have a selfish interest in seeing that electric heat applications are extended as rapidly as possible on a sound economic basis.

One way to stimulate usage is to collect as convincing



Two furnaces 8 ft. square inside working dimensions and rated at 200 kw. each with some of the forgings which are heat treated in them. The heating units are under the hearth and suspended from the roof of the chamber.



Four 100-kw. furnaces, 4½ ft. wide by 7 ft. long, used for carburizing and hardening thousands of small refrigerator parts weekly. These are equipped with motor-operated doors actuated by push-buttons located within easy reach of the operator's hand.

economic data as possible and be able to show a prospective user the installations to which the data apply. In this task the electrical industry need not be handicapped by the secretiveness of many manufacturing industries if electrical manufacturers will use electric heat in their industrial processes wherever it is economically justified and disseminate experience and costs obtained with such installations.

The accompanying illustrations show some installations of electric furnaces which were selected by the General Electric Company's production department, not because they were electric, but because economic studies proved them to be advantageous. They are being used for heat treating anything from refrigerators to turbine parts to develop their maximum tensile strength or uniform surface hardness. With thousands of parts being treated the rejections caused by imperfect heat treatment are practically none. Subsequent machining operations may be greatly affected by the character of the heat treatment, which with electric heat is superior to other forms.

The four 4½-ft. furnaces at the top of this page turn out weekly 10,000 compressor shafts, weighing 2 lb. each, to be carburized and hardened, a total of 40,000 lb.; 20,000 bushings, ⅜ in. diameter by ⅞ in. long, to be carburized and hardened, a total of 7,500 lb.; 10,000 collars, 1½ in. diameter, to be carburized and hardened, a total of 2,500 lb.; 20,000 bushings, 1 in. diameter by 1½ in. long, to be carburized and hardened, a total of 5,000 lb.; 15,000 cap screws, ¼ in. x 1¾ in., to be hardened and oil-treated, a total of 950 lb.; 70,000 three-headed bolts, ⅜ in. x 4¼ in., to be hardened and oil-treated, a total of 11,000 lb.; 26,000 pins, ⅜ in. x 2¼ in., to be carburized and hardened, a total of 1,600 lb.

In the three furnaces in the center of the line, which are 6 ft. square and rated at 100 kw. each, 3,000 Ascoloy turbine buckets averaging 25 lb. each are heat treated each week.

Some of the wide variety of parts which are carburized and hardened in electric furnaces. Carbon steel washers, 1½ in. in diameter, and Ascoloy forgings, from which turbine buckets are later shaped, are treated by the hundreds and thousands with absolute uniformity of product.

Letters from Our Readers

Cost Specialists and Small Plant Rehabilitation

To the Editor of the ELECTRICAL WORLD:

The October 26 issue of the ELECTRICAL WORLD carries two items that are very interesting. On page 821 is the editorial on "Cost Specialists Needed." This is good and is an excellent introduction to the article on page 829, on "Small Plant Rehabilitation."

Twice this week I have been talking to men in the power business, one the chief engineer of one of the leading waterwheel manufacturers and the other the general manager of a very big power company. One might deduce after hearing these men talk that the time has certainly come when the truth of the editorial "Cost Specialists Needed" is apparent. Both of them dwelt on the trend toward very big single-power units, implying it was a "fad" without sane reason based on economy.

A short study may well make one wonder if there is not a "fad" in power unit design just as there is in women's clothes.

There is the case of a single 60,000-kw. steam turbine unit that for some cause went out of service and required repairs. Any unit that large must of necessity be special in construction and so any repairs would be very expensive. Would not repairs for a standard size 20,000-kw. machine cost very much less and, of course, in proportion to the size? When this unit went out of service it took such a big block of power off the line that the cost of substituting that amount of power or losing the revenue was terrific.

Let me quote as near as I can recollect the remarks of the chief engineer of the waterwheel manufacturer:

> The power companies will wake up soon to realize the foolishness of using these great big units.
>
> Take a concrete example, a 90,000-kw. plant using two 45,000-kw. units. The cost of the waterwheels and generators, which are of course special for this one particular condition, will be the same per horsepower as six 15,000-kw. units.
>
> The cost of the power station to house 45,000-kw. units will be the same as, if not quite a bit more than, for 15,000-kw. units, because the length of the power house, in each case, will be the same in clear waterways. The only difference is that using a larger multiple of units will require more division walls, so the actual width may be a few feet longer. But the structure permits lower construction costs since the open waterways are smaller, and therefore lighter construction can be used. The width of a power house for 45,000-kw. units will be much more than for 15,000-kw. units. The big item, however, is in the cost of excavation. The excavation for draft tubes for a 45,000-kw. unit is at least a third more than the cost for excavation for 15,000-kw. units that do not have to be anywhere near so deep.

This engineer commented further on costs after plant installation and stated:

> The biggest point to consider is the cost of repairs and cost of shutdowns due to loss of revenue. The repairs for a 45,000-kw. waterwheel are very expensive, while for the 15,000-kw. sizes this item is not a serious matter.
>
> The loss of revenue and the fixed charges which continue after shutting down a 45,000-kw. unit are double the amount for the loss of a 15,000-kw. unit. Furthermore, the system does not undergo the disruption of service caused by the loss of a big unit.
>
> The fad of insisting on a stand-by unit or one that will be used not over two to four months out of any year requires an investment which may make it impossible for water power to compete with steam. The use of smaller multiple units permits greater economy of water, and the stand-by unit is a smaller item of expense.
>
> Steam power, due to great advances in design, has become a close competitor of water power, so engineers have to put in more economical units to obtain more economical power stations. This is bound to require the use of smaller size units and multiple-unit plants.

Leading to another thought stimulated by your article on "Small Plant Rehabilitation," page 829, how many of these former individual small hydro-electric plants have been bought by the big power companies? How many of them are still used? I do know that many are now out of use, and yet there is water flowing to waste over the dams because the equipment is antiquated and inefficient. However, by making a very small investment for new equipment these small plants can be put back to useful work, conserving natural resources. Small plants can be utilized along high lines as synchronous condensers to correct power factor and regulate voltage. Making them remote automatic controlled eliminates cost of operators.

Synchronous condenser plants have been built to correct this trouble, and I dare say in all cases they are most needed, but the expense could be eliminated by giving more thought to the matter and utilizing natural resources at hand. There are cases in which small isolated water powers can be used and which the power companies own, but do not use. There are cases in which a mill has a small antiquated water power and turns around and buys power from the power company. A bit of sensible unselfish co-operation can revamp that water power so that it, acting as the condenser, will correct all the power factor and voltage regulation trouble.

The chief point which I wish to make is that every water-power plant, no matter how small, becomes, when used as a condenser plant, a "wet cow," whereas the specially built strictly electrical condenser plants are all "dry cows." They become a double expense on any system: (1) Cost to build and (2) cost for power to operate. The "wet cow" costs no more to build or revamp and it brings in additional revenue to the power company. Where there is co-operation between the mill owners and the power company a saving in power costs is experienced by the mill owner.

H. H. WHITE,
Southern Sales Manager.
James Leffel & Company,
Atlanta, Ga.

Winners of Safety Trophies

To the Editor of the ELECTRICAL WORLD:

We note on page 804 in the October 19 issue of the ELECTRICAL WORLD that mention is made of the fact that the West Penn Power Company won the 1929 trophy awarded by the National Safety Council.

In fairness to the other companies which participated in this contest, we think you should make mention of the trophy winners in the other groups of public utilities. We are listing below these winners:

	Accidents
Electric group employing over 1,000:	
West Penn Power Company, Pittsburgh	15
Electric group employing less than 1,000:	
Iowa-Nebraska Light & Power Company, Norfolk	0
Gas group employing over 1,000:	
Equitable Gas Company, Pittsburgh	2
Gas group employing less than 1,000:	
Los Angeles Gas & Electric Company, Los Angeles	0
Combination gas and electric group employing over 1,000:	
Wisconsin Public Service Corporation, Milwaukee	5
Combination gas and electric group employing less than 1,000:	
Superior Light & Power Company, Superior, Wis.	0

C. B. BOULET,
Insurance and Safety Department.
Wisconsin Public Service Corporation,
Milwaukee.

Digest of Foreign Literature

Hydro-Electric Development and Steam Equipment

Modern Use of Pulverized Fuel in Power Stations.—R. A. CHATTOCK.—As a result of the experimental work carried out in the Birmingham electric power station, in England, it has been demonstrated that the use of pulverized fuel gives a higher combustion heat efficiency in the boilers than is obtained with mechanical stokers. Boilers having a capacity far greater than those equipped in the past with mechanical stokers can be used, with a consequent reduction in the capital cost of boilers and the boiler house. This is a set-off against the higher capital cost of the pulverized-fuel equipment compared with mechanical stokers. According to the author, the evolution of pulverized-fuel installations is tending toward reduced equipment and greater simplicity in operation. This is effected by eliminating the coal driers and the conveying and storage of the pulverized fuel. While this may or may not agree with contemporary observations and practices in the United States, the author has based his observations upon the results obtained on two separate systems of pulverized fuel firing at the Birmingham station.—*Journal of Institution of Electrical Engineers (England)*, October, 1929.

Compressed Air Circuit Breakers.—K. A. WIEDAMANN.—Several designers have recently called attention to a possible replacement of high-voltage oil circuit breakers with air-break switches, using compressed air to extinguish the arc. The writer of this article went through patent literature and publications of the last 29 years and found a considerable number of switch design of American and European origin, covering breaker constructions, in which a powerful jet of air is used to blow the arc out. Among the actually built switches seven types are described and illustrated.—*Elektrotechnische Zeitschrift*, October 10, 1929.

Units, Measurements and Instruments

Portable Electric Harmonic Analyzer.—R. THORNTON COE.—A description of a supposedly perfected dynamometer method of harmonic analysis in which accuracy and speed of operation have been combined with portability. Although intended primarily for the analysis of the voltage waves on power circuits, where it gives the harmonics correct to 1/20th of one per cent of the fundamental, the method also may be used for the analysis of current waves and for finding the phase angle between harmonics of the same frequency in two different ways. Each harmonic is found separately from steady readings on two instruments. As pointed out by the author, in the dynamometer method of analysis, a current related in some way to the voltage or current to be analyzed is passed through one coil of a dynamometer instrument, while through the other is passed a sinusoidal "analyzing current" of exactly the frequency of the harmonic required to be found. The special feature of the present method is the production of the "analyzing current" by means of a synchronously driven contact disk of special design and a valve circuit. Detailed operation of the analyzer is described and the accuracy of the instrument is established.—*Journal of the Institution of Electrical Engineers (England)*, October, 1929.

Heat Applications and Material Handling

A Special Electric Furnace.—W. J. WYLIE.—A special electric furnace, said to be the only one of its type in Canada, is described in this article, the protective and automatic features being notable. The furnace is of the horizontal pusher type, 36 ft. long with a loading door at one end and an unloading door at the other. The furnace chamber is 30 ft. in length and is divided into six zones by fire brick baffle arches suspended from the furnace roof, of which they form an integral part. The furnace elements are derived for 220-volt, three-phase operation. There are six operating zones, the first having an electrical capacity of 100 kw., the second 50 kw., the third has no electric resistance elements installed in it and four, five and six have an installed capacity of 30 kw., making a total of 240 kw. for the complete furnace. The supply voltage, which is 550, is stepped down to 220 by means of transformers. Maximum temperatures are 1,600 deg. F. The control system is of particular interest and a complete description of this element has been given. It is stated that the successful results secured by this furnace installation are due in a large measure to the accuracy of heat control which can be secured, this being necessary when uniform results are desired, while at the same time maintaining modern production speed in the plant. The five zones in the furnace that are equipped with electric heat units are each controlled by a separate controlling pyrometer through a control panel. The pyrometers are set for the temperature desired in each zone of the furnace and maintain this temperature automatically.—*Electrical News and Engineering (Canada)*, October 1, 1929.

Illumination

Street Illumination in Vienna (Austria).—H. SCHLÖGEL.—Series lighting with 45-volt, 220-watt lamps, five in series on 220 volts of either direct current or three-phase alternating current is used in Vienna. To maintain the remaining lamps, if one or more of the series should burn out, a relay is connected to each unit, which cuts a resistance or choke coil in the line if the lamp gives out. It was found frequently that a destructive arc remains when the filament breaks. To remedy this trouble, the latest type lamps have two small quartz tubes threaded over the two main lead-in wires. In case of a filament break the ensuing arc is positively interrupted by the sliding off quartz tubes. To lessen the cost of installation all wiring is exposed overhead and wherever possible the lamps are attached to either the cross wires or to the masts of the trolley system. The system is divided into two main series, part-night and full-night lights, controlled automatically by adjustable time switches.—*Elektrotechnik und Maschinenbau*, September, 8, 1929.

Miscellaneous

Testing of Porcelain Insulators.—L. GOODLET.—In recognizing that in the selection of high-voltage insulators engineers at the present time are guided mainly by the principles implicitly or explicitly laid down in the various national insulator specifications, the author points out that these governing ideas of the specifications are not unsound, but that they are somewhat incomplete. The directions in which inprovements may be effected to advantage have been approached through an analysis of failure causes, which are excessive voltages, reduced insulation strength and mechanical failure. While the author has analyzed existing practices and advocated and suggested a number of alterations in practices, he states that it is neither possible nor desirable to devise tests which will locate every possible source of trouble. This is said to be due to a lack of simplicity in the causes, and it is for this reason that the specification of freak tests of individual purchasers are unfortunate. The best guarantee of a reasonably prolonged life for an insulator, according to the author, is the assurance that the manufacturers themselves devoted extensive thought to their problems and run both their engineering and manufacturing departments under strict scientifical control.—*Journal of the Institution of Electrical Engineers (England)*, October, 1929.

News of the Industry

Arizona to Fight Wilbur Boulder Dam Plan

Colorado River Commission of State Expresses Its Emphatic Dissent from Proposal and Gives Eight Grounds on Which It Will Base Legal Action

CHARGING that California is trying to complete Colorado River contracts with Secretary of the Interior Wilbur in order to eliminate both water and power revenues as subjects of negotiation before resuming the attempt to agree with Arizona in a compact, the Colorado River Commission of Arizona has ordered legal action to ascertain whether "in sovereign right, power and dignity Arizona stands on a plane of equality with the other states of the Union"; also whether the federal government under what the commission terms a pretense of regulating navigation in the Colorado River may take charge and control of all of its waters for all purposes and engage in the purely commercial undertaking of selling these waters and the power produced thereby.

The commission declares that it will also seek to ascertain whether a purely southern California enterprise may masquerade in Arizona as a federal project and appropriate to itself powers, privileges and immunities which as a California enterprise it could neither demand nor enjoy. Arizona, the commission insists, lays claim to a reasonable share of the water of the Colorado River, notwithstanding the Colorado River compact, which seeks to reserve in perpetuity to the upper basin an enormous quantity of water which Arizona's representatives say it can never use, and notwithstanding the Swing-Johnson act, which, they assert, seeks to federalize the water and power development of the river for the particular benefit of southern California.

The commission has notified the California and Nevada commissions of its stand and has authorized and directed the Attorney-General of Arizona to take such legal action as may be proper and necessary. Governor John C. Phillips last week telegraphed to Secretary Wilbur the reasons on which legal action is predicated by the Arizona Colorado River Commission. These are as follows:

1. California wants practically all of the available water in the river for irrigation purposes and for use on the coastal plain. For Arizona to concede these demands would mean that new developments made possible by the project would take place in California and not in Arizona.

2. The Imperial and Coachella valleys are to receive water for irrigation and other purposes without paying anything whatever to the project, whereas no such gratuity is extended to Arizona.

3. It was generally understood that California would be expected to pay $1.50 per acre-foot storage and delivery charges for water diverted to the coastal plain. Arizona requested a minimum charge of $2, and California asserted it could not be more than $1. The Secretary of the Interior now proposes to charge only 25 cents.

4. The project was intentionally placed at the nearest available point to the California power market and the most remote from the Arizona power market.

5. The commission is firmly of the belief that the Swing-Johnson bill is unconstitutional.

6. The United States is to advance upward of $40,000,000 without interest to enable California vastly to increase its appropriation and use of the water of the Colorado River, whereas no provision is made for any such aid to Arizona.

7. When the project is fully paid for, Arizona's right to share in the revenues thereof ceases.

8. The proposed charge for water delivered to the coastal plain of California runs counter to the apparent intent of Congress that the project shall be so operated as to produce revenue for Arizona and Nevada. Prohibitive transmission costs and the relatively small demands for electricity in Arizona make it impossible for large consumers in Phoenix and the large mining camps of eastern and southern Arizona to use Boulder Dam power.

Boulder Dam Proposals Satisfy Nobody

Southern California Edison Company Says Division of Power Is Unfair—Metropolitan Water District Wants Government to Build Plant and Install Machinery

CONFRONTED with the threat of litigation by Arizona and Nevada that would suspend work on the Boulder Dam project until the federal Supreme Court rules on the constitutionality of the act, the conference held at Washington on Tuesday and Wednesday under the guidance of Secretary of the Interior Wilbur produced little but a restatement of conflicting demands. The allocations tentatively suggested in the Secretary's statement of October 21 apparently were not acceptable to any of the parties. Secretary Wilbur announced at the close of the hearing that his decision on allocation of power and the terms of participation by public and private applicants would be reserved until the second week in December in order to give the three lower states another opportunity to reach agreement.

California Edison States Case

The Southern California Edison Company protested that the proposed division of power is unfair to the customers of the public utility companies and contrary to the public interest, which is the controlling consideration under the law for the allocation of power. The company objected to the plan to make the Metropolitan Water District a direct and principal contractor, contending that the district can be wholly protected as to its needs for power for pumping water by proper provisions in the contracts.

The proposal to have the price readjusted upward or downward at the time of completion of the dam is unacceptable to the company because of the serious obstacle to financing the necessary expenditures for power machinery and transmission that the possibility of a greatly increased price for power would set up. The company interpreted Secretary Wilbur's proposal of October 21 as meaning that the board of control to be created would be actually in charge of the operation of the power plant and that this board would employ the plant manager. It is also the company's understanding that if a contract is entered into by the government with it, that contract is to be made directly with the Secretary of the Interior and not with the city of Los Angeles and the Metropolitan Water District. The company maintained that the contract with it should be on a parity with the contract to be made with the city.

The representatives of the company further argued that this is not a contest between private power companies and public agencies, but between two groups of public agencies. They declared the utility companies to be just as much of a public agency as those which are financed through involuntary subscriptions under the taxing power, pointing out that the utilities are under public regulation and control and that this regulation is based upon the principle that their business is clothed with a public interest.

Reciting that the municipal agencies supply less than one-fifth of the total power consumed, whereas the public utility companies represented supply more than four-fifths of the total now distributed for the population and industries in the territory, it was declared that the tentative allocation would turn over to these users of less than one-fifth of the power in southern California almost three-fifths of the power available for distribution from Boulder Dam. Secretary Wilbur was reminded that 99 per cent of agricultural power now is supplied by public utility companies.

The only real interest to be served by discrimination in favor of the publicly owned agencies, spokesmen for the power company asserted, is the public ownership movement, and they expressed confidence that the Secretary would not use a federal project in such a manner as to stimulate the growth of the public ownership movement in southern California. The belief was expressed that the Metropolitan Water District will have all the burden that it can possibly stand if it confines its expenditures to those required for building the Colorado River aqueduct and is not required to advance from $10,000,000 to $40,000,000 more for power-house equipment and transmission lines.

PROPOSALS FROM PUBLIC PLANTS

The proposals presented at the hearing by the spokesmen for the city of Los Angeles and the Metropolitan Water District were that the city should be designated as the sole agent in charge of operation of the power plant and the main transmission lines, that if allocation of power without a hand in control is not acceptable to the private companies the city will use it and pay for it, that the government should build the plant and install the machinery, that the proposed board of control should function only in an advisory capacity and should be recast to include one representative of the private companies, one of the city of Los Angeles, two of the Metropolitan Water District and one or more of the government, and that the dam should be erected to the greatest height feasible. Increasing the height of the dam was urged in the interest of economy, which, it was maintained, could not be obtained in a dam limited to a height of 550 ft.

H. G. Palmer, vice-president of the Board of Water and Power Commissioners of the city of Los Angeles, declared that public opinion is opposed to the allocation of power to private interests and the board's concession in that respect is subject to the condition that operation of the power plant shall be placed in the hands of the city. The arguments presented on behalf of Los Angels were indorsed by officials of the small municipalities.

NEVADA'S POSITION

Spokesmen for the State of Nevada reiterated their demand for allocation of one-third of the power developed by the dam, representing that the allocation of 18 per cent proposed in Secretary Wilbur's statement made the interests of that state subservient to those of municipal and private interests. They also contended that until such time as this power is required in the industrial development of the state itself the state should be permitted to sell it outside of its boundaries. Although it will be many years before the state can make use of one-third of the power developed by the dam, Senator Oddie contended that this share should be reserved to the state in order to promote the development of its natural resources. Allotment of 75 per cent to the city of Los Angeles and the Metropolitan Water District, he asserted, would create a political power organization inimical to the rights of Nevada.

Colin G. Fink, professor of electrochemistry at Columbia University and secretary of the American Electrochemical Society, urged the desirability of utilizing all the power at the dam site, explaining that it is cheaper to haul raw materials to the dam than to transport power over transmission lines. He expressed the belief that if Nevada can offer industry power at a cost of $15 per horsepower-year, Nevada's share, because of its mineral resources, will be soon taken up.

Secretary Wilbur said that the preference rights of Nevada and Arizona are recognized. On behalf of Los Angeles and the Metropolitan Water District, W. B. Matthews offered to negotiate an agreement with these two states providing for utilization of the states' surplus subject to drawback from time to time.

Nevada, Too, Ready to Take Fight to Supreme Court

Nevada is prepared to carry its fight for a "rightful share" in Boulder Dam power to the United States Supreme Court, E. W. Clark, member of the Colorado River Commission of Nevada, said last week after a meeting of the commission to consider the allocation of power sponsored by Secretary of the Interior Wilbur. Nevada, he declared, will oppose the Wilbur provision allowing Los Angeles and southern California to sell their share of Boulder Dam power wherever they wish, but restricting Nevada to its own boundaries.

Utah Attacks Suggested Price for Colorado Power

The Colorado River Commission of Utah has issued a protest against the sale of Boulder Dam power at 1.63 mills per kilowatt-hour, according to a statement issued by Governor George H. Dern on November 9. The protest was adopted at a meeting held with the Governor and was signed by the three river commissioners, W. R. Wallace, W. W. Ray and W. R. Beers.

The protest states that Congress did not intend to provide southern California with a large supply of electric power at less than competitive rates, and asserts that the rate of 1.63 mills proposed by the Secretary of the Interior on the recommendation of Commissioner of Reclamation Mead would be less than competitive. The cost of the power should not control the selling price, except that it must be adequate to provide for repayment, but should be controlled by competition, it is asserted.

The Utah commission maintains further that the charge of 25 cents per acre-foot for storage for the Metropolitan Water District in the Los Angeles territory is only a nominal charge and not a reasonable charge that should be made for the service.

Wholesalers at Cleveland

Animated Discussions Characterize Meeting of the N.E.W.A.—Chairman Cullinan Optimistic

DISCUSSION, rather than prepared papers, held sway at the convention of the National Electrical Wholesalers' Association at Cleveland on Monday to Friday of this week. The sessions were well attended, and the interchange of opinion on the problems now dominant in the field of commercial electrical distribution was free and frank.

Monday and Tuesday were devoted to committee and divisional meetings, the general sessions opening Wednesday. Chairman George E. Cullinan sounded the note of common-sense consideration of the business conditions affecting the wholesaler in the electrical industry today. A wholesome optimism informed his remarks. Compared with 1921 both wholesaler and retailer find themselves, he said, in a much more favorable situation. Instead of a heavy inventory on all lines, they are today realizing the benefits of hand-to-mouth buying. The only exception is in radio apparatus, where action is called for.

W. W. Williamson, vice-president Alpha Electric Company, made a well-considered address on the responsibilities of association membership.

Much of one session was devoted to the consideration of lamp business. Not only were important reports by the N.E.W.A. committees brought in, but G. S. Merrill of the National Lamp Works presented figures showing the effect on lamp sales of burning undervoltage lamps. An important discussion on this point led to a motion to support the movement on the part of the lamp companies to supply lamps of proper voltage only.

On Thursday the sessions were divided between a consideration of a proposed new credit plan by W. T. Ackerly, counsel to the association, and a presentation of the importance of market study to the wholesaler by C. J. Litscher, president Litscher Electric Company, Grand Rapids. On Thursday evening the manufacturers were hosts at a banquet.

President of Rochester Gas & Electric Commits Suicide

Friends and associates of Robert M. Searle, president of the Rochester (N. Y.) Gas & Electric Corporation, were shocked on Wednesday to learn that he had committed suicide by inhaling gas at his Rochester home. The tragic event is ascribed to temporary mental derangement occasioned by heavy losses in the stock market.

Mr. Searle, who had shown much ability both as an engineer and as a financier, had been connected with the Rochester property for 23 years under various changes of ownership. He was an Edison Pioneer and had reached the age of 60. A biographical sketch will be printed next week.

Commission Investigators' Stock Holdings

New York Inquisitors Vote Down Motion that They State Their Utility Ownings—Lunn and Van Namee Succeed Prendergast as Witnesses

THREE members of the legislative commission investigating public service commission law and practice in New York State voted at the first of two sessions held last week for a resolution which would have placed on public record the stock holdings and other interests that the members of the legislative commission might have in public utility securities. These three members were Prof. J. C. Bonbright, the mover of the resolution; Frank P. Walsh and David C. Adie, all appointed by the Governor. Four of the six legislative members voted in the negative and defeated the proposal. Two were absent.

Testimony was resumed by William A. Prendergast, chairman of the Public Service Commission, who opposed a suggestion that the cost of a proposed bureau of research acting as a fact-finding body for the Public Service Commission might be levied against the utilities. Commissioner Prendergast favored the bureau but maintained that it should be paid for by the taxpayers as a whole.

At the second session Commissioner George R. Lunn was called to the stand. Mr. Lunn thought that a decrease of rates by some light and power companies was in order. He defended the Consolidated Gas - Brooklyn Edison merger. Mr. Walsh inquired whether Mr. Lunn thought the 7-cent rate was fair for small consumers of electric light, but the commissioner would not give an opinion. He did say that with improvements about to be suggested a reduction should be made. Asked how long he had been trying to bring about a rate reduction, the witness said that the New York Edison case had been before the commission four years but the postponements were requested by the city. He also expressed the view that the federal courts were encroaching on the regulatory powers of the state, citing the New York Telephone Company valuation as an instance.

When the investigating commission reassembled on Wednesday of this week Public Service Commissioner George R. Van Namee took the stand and gave it as his opinion that "the control of the Public Service Commission can be made more effective by clearing up legislative ambiguities and extending its control to holding companies." In general Mr. Van Namee agreed with the proposals already submitted to the inquiry by Chairman William A. Prendergast of the Public Service Commission, and while admitting that there was room for improvement, he insisted that "there has been a substantial measure of success in public utility regulation," especially when the handicaps of a limited staff and budgetary difficulties are taken into consideration.

Mr. Van Namee favored the establishment of a technical bureau to aid the Public Service Commission by keeping watch on the business and operation of public utilities, provided that it did not become a "snooping bureau." He declared that "you can't keep a company from going into the courts."

Boston Edison Company Is Attacked on Rates

A sweeping attack directed against the management of the Edison Electric Illuminating Company of Boston marked the beginning of the Massachusetts Department of Public Utilities' investigation last week into the rates of this leading New England central-station organization, the full board being present. W. C. Marshall of Watertown headed a drive against the company's rate schedules and introduced preliminary figures purporting to show that the prosperity of the company warrants substantial rate reductions. An assault upon the work of the New England Bureau of Public Service Information, which is supported by public utilities of varied service in the Northeast, marked Mr. Marshall's address.

Counsel for the city of Boston and many other municipalities served by the Edison company entered their appearance, and the usual contingent of "radical" attendants at State House hearings appeared and attempted to draw out advance statements from the company's officials as to the situation. President Charles L. Edgar attended the entire session, but Chairman Attwill of the commission refused to order any one to take part in the proceedings at this stage.

In due course the company's answers to the inquiry in every phase will be presented. The hearing was adjourned until November 27, to allow the company's opponents to formulate interrogatories. It is probable that the case will be greatly protracted on account of the scope of the projected inquiry initiated by the commission and joined in by the formidable array of municipalities represented in the initial proceedings.

Hearing on Portland Electric Power Rates Open

The long-looked-for hearing on the valuation and rates of the Portland Electric Power Company opened in Portland November 12 before the Oregon Public Service Commission with Frank R. Miller, chairman, presiding. Adjournment was taken on the next day until December 2 to permit the commissioners to attend a railroad case in San Francisco.

The first two days were consumed in direct examination of J. P. Newell, consulting engineer, and C. R. Lester, chief engineer of the commission, who submitted testimony on the valuation of the company. No time has yet been found for cross-examination of the witness or for presentation of testimony on the part of the city or the company. These phases of the hearing will be taken up in order when the hearing reconvenes.

Senate Directs Interstate Power Inquiry

Adopts Couzens Resolution Instructing Trade Commission to Report on Volume of Energy Transmitted Across Boundaries and Number of Companies Supplying It

ONE more task for the Federal Trade Commission was formulated on November 8 when the Senate adopted a resolution moved by Senator Couzens of Michigan directing that commission to investigate and report to the Senate the amount of interstate transmission of electrical power, whether it is transmitted between the same or different companies, the names of these companies and the relation between the amount of electrical energy consumed in a state and the amount produced there.

Mr. Couzens explained that the purpose of his resolution is to determine positively the gross interstate transmission of power. It has been widely circulated, he explained, that this figure is "negligible," and this has been used generally as an argument against including power transmission in the scope of the Commission on Communications and Power which Mr. Couzens proposes to create in a bill now pending. While the net interstate transmission of power may be small, he contended, the Interstate Commerce Committee chairman has been advised that the gross exchange is large. The Senator said he understood the Trade Commission has the information at hand as part of the facts uncovered in its power inquiry.

Bay State Inquiry Draws a Small Attendance

Little interest was shown at the opening session of the special commission investigation into public utility affairs on Wednesday of this week at the State House in Boston, judging by the small attendance and short time occupied by the hearing. W. H. Walker, secretary of the Public Franchise League, Boston, urged enlargement and fuller publication of returns filed by operating and holding companies with the Department of Public Utilities, also advocating the publication of answers to the special commission's questionnaire recently sent to Massachusetts companies. Several utility men were at the hearing, but no questions were put to them by commission members. Whitfield Tuck, a local

politician, challenged the members of the committee to show that they were not holders of utilities stocks. It was announced at the close of the hearing, which lasted only an hour and a quarter, that due notice would be given by the commission in case it was decided to hold further sessions.

Flathead River Brings Out Voluminous Testimony

Contest Between Montana Power Company and W. H. Wheeler Leads Indian Bureau Counsel to Suggest Federal Development of Disputed Site

ANOTHER proposal that the United States government enter the field of hydro-electric generation was made last Saturday by J. Henry Scattergood, assistant counsel for the Bureau of Indian Affairs, when he testified before the Federal Power Commission in its protracted hearings on the Flathead River site on an Indian reservation in Montana. Mr. Scattergood's suggestion was that the government could finance development at 4½ per cent instead of the 8 per cent that the Montana Power Company, whose subsidiary, the Rocky Mountain Power Company, is so far the preferred applicant, would have to pay. Congressmen present at the hearing expressed the view that there was no chance that authority for a government plant would be granted by the legislators "within the lifetime of the settlers."

The first week's hearings were noticed in the ELECTRICAL WORLD for November 2 (page 899). Subsequent testimony concerned among other things the pre-license expenses of the Rocky Mountain Power Company. This expense account had led to the introduction of a resolution in the Senate calling for its investigation which alleges that applicants for rights at Flathead Lake spent large sums of money at Indian powwows, that the Montana Power Company charged to pre-license costs the salaries and expenses of its officials, and that the Rocky Mountain Power Company made donations to churches, schools and organizations in the district. The commissioners at the hearing appeared satisfied with the testimony on these costs given by F. M. Kerr, general manager of the Rocky Mountain Power Company.

Edward P. Burch, consulting engineer of Minneapolis, who supported the rival application of Walter H. Wheeler, maintained that Mr. Wheeler would be able to sell his power cheaper than the Rocky Mountain Power Company because he would be unencumbered by relations with other power projects and by the rate structures. The estimate of $18,000,000 made by Mr. Wheeler for the construction of sites Nos. 1, 2, 3, 4 and 5 was attacked by counsel for the Rocky Mountain company. Prof. A. E. Wells of Harvard gave his reasons for believing that fertilizer could not be produced at Flathead Lake at a cost which would enable it to compete with other sources of supply as maintained by Mr. Wheeler. The power company stressed the need for more power than is now available in the section of Montana affected.

H. H. Cochrane, chief engineer of the Montana Power Company, testified that the average sale by that company would be 68,000 hp. of primary energy. Mr. Wheeler had previously informed the commission that his average annual sale would be 105,000 hp. Mr. Cochrane said that he had not included secondary power in his sale estimates, because secondary power is only available during flood times, when there is practically little demand for it. Only a small amount of secondary power, he said, could be utilized for pumping water to nearby irrigation districts. Mr. Wheeler in his plans included secondary power and testified that he proposed to sell this power to farms in the irrigation districts and the Indians.

Two weeks of continuous hearings before the Power Commission have apparently developed little new information in connection with the project. Men who have followed the hearings closely say that to them the original conclusions of the commission's staff seem sound and that the weight of the evidence favors the granting of the rights for the project to the Rocky Mountain Power Company. Mr. Wheeler predicated his case largely upon the assumption that fertilizer manufacturers could be induced to set up plants at the site. The hearing disclosed that it is highly improbable that Flathead Lake could be made a center of fertilizer production. It has also shown that there are no definite offers pending from fertilizer companies to buy power. In one case the established power company in the region has an assured market for its output the minute the plant is completed. In the other the market depends upon the establishment of an industrial community.

Purchases and Mergers

Forty Municipal Plants Sold to Private Companies in Iowa, Missouri, Kansas and Nebraska in Twelve Months

A SURVEY just completed by Secretary Thorne Browne of the Middle West Division of the N.E.L.A., comprising Iowa, Kansas, Missouri and Nebraska, shows that in the twelve months ended October 1, 1929, 48 electric light plants in as many separate localities were sold to transmission-line companies. Forty of these were publicly owned plants. Comparatively few isolated privately owned plants remain. The population served by public plants has dropped in three years from 210,000 to 202,862, while private plants have increased the population served from 473,000 to 551,000. The survey, Mr. Browne says, shows that reductions in rates accompanied nearly every switch from public to private ownership.

Permission has been granted by the Tennessee Railroad and Public Utilities Commission to the East Tennessee Light & Power Company (formerly the Tennessee Central Service Company) to issue securities to acquire the Bristol Gas & Electric Company, Newland Light & Power Company, Elk Park Electric Light & Power Company, Tennessee Eastern Electric Company, Watauga Power Company, Bluff City Electric Light & Power Company, Erwin Electric Light & Power Company, Butler Light & Power Company and Roans Creek Light & Power Company.

Early acquisition of the transmission system of the Tazewell (Va.) Electric Light & Power Company by the Appalachian Electric Power Company, which is first to supply the Tazewell company with energy for Tazewell and North Tazewell at wholesale rates, is expected. This agreement follows litigation previously noted (ELECTRICAL WORLD for June 22, page 1305).

The Haywood (N. C.) Electric Power Company has been sold to the Carolina Power & Light Company and will be managed as part of the Asheville division.

An offer of $385,000 for the municipal electric light plant at Coleman, Tex., has been made the City Commission by the West Texas Utilities Company. The commission may call an election on the proposal. A plan to sell the light plant for not less than $125,000 was voted on by the citizens in 1926 and was overwhelmingly rejected, the vote being 596 to 40.

The Potomac Edison Company has been authorized by the Maryland Public Service Commission to purchase for $15,000 the franchises and system of the Damascus Light & Power Company.

Official confirmation of the sale of the Athens (W. Va.) Power Company to the Appalachian Electric Power Company was made on November 2. The consideration was $67,000. The Athens plant will be absorbed by the Princeton branch of the Appalachian company.

The Utilities Power & Light Corporation has applied to the Missouri Public Service Commission for authority to acquire more than 10 per cent of the capital stock of the Laclede Gas Light Company and the Laclede Power & Light Company of St. Louis. The holding company now owns all of the stock of the Laclede Gas & Electric Company. The Laclede Power & Light Company seeks to transfer all of its stock in the St. Louis companies to the Utilities Power & Light Corporation.

An offer to pay $175,000 cash for the municipal electric plant at Macon, Mo., and to give the city free street lighting and city water pumping for ten years has been made by the Missouri Power & Light Company.

The towns of Heartwell and Palmyra, Neb., have sold their electric distribution systems to the Central Power Company.

Trustees of the village of Blair, Wis., have written to the Railroad Commission stating that President Knutson of the village was not authorized by the Village Board to ask the commission to hold a hearing preparatory to the village taking over the property of the Northern States Power Company, which serves Blair. The trustees want 90 days' time in which to try new company rates. The commission has postponed the matter indefinitely.

Authority has been given by the Illinois Commerce Commission to the Illinois Power & Light Corporation to purchase the Hittle Electric Light Company in Tazewell County, Ill.

Arthur and Elmer Hackett, operating an electric plant supplying residents of Woodhull, Steuben County, N. Y., with electricity, have petitioned the Public Service Commission for permission to transfer their property to the New York Central Electric Corporation of Perry, N. Y.

Combination Locomotives Prove Utility

Operating Experience in Illinois Central Yards Demonstrates Value of Trolley, Storage-Battery and Furnace Oil-Burning Switching Engine

PROMISE of urban railroad operation without the usually attendant smoke and cinders from steam locomotives is held out by the operating experience obtained from an electric engine that has been in use for several months in the Illinois Central yards at Chicago. This engine is a 90-ton general-purpose electric locomotive built and equipped by the St. Louis Car Company. It may be operated from a trolley in places where a contact system is available or it may supply its own power from two Buda Company furnace oil engines which charge a 180-cell "Exide" storage battery that floats on the system and supplies peak energy for starting pulls. The motors and control equipment were furnished by the General Electric Company.

The performance of this engine has been so satisfactory that the New York Central Lines have ordered 42 similar locomotives. This statement was made at a luncheon in Chicago on November 5 at which railroad and electrical men had gathered to inspect the locomotive and hear about its operating performance. The experience in the Illinois Central yards, which are partly electrified, shows that the locomotive operates about 45 per cent of the time on the trolley and the remainder on the engine and battery. It works 24 hours a day and is normally out of service for one eight-hour shift period each week for inspection and maintenance. The cost of this locomotive is about 70 per cent of that of a straight oil-electric, and its life except for the oil engines and battery is estimated to be about the same as for a steamer.

"Three-Power" Locomotives for Lackawanna Railroad

Two "three-power" Diesel electric locomotives—the first of their kind built to operate on 3,000-volt direct current, taking power from an overhead trolley instead of through third-rail contact—have been ordered by the Delaware, Lackawanna & Western Railroad.

The electric trolley, the oil-electric engine and the storage battery combine to furnish power to operate this new type of terminal locomotive. In main-line work they will operate as straight electric locomotives, taking power from an overhead wire. When working off electrified trackage they will operate as combination oil-electric, storage-battery locomotives.

This flexibility obviates the necessity for electrifying the switching yards and industrial sidings in the zone in which they will be used. Another element of efficiency which their introduction will represent is a distinct saving of time in fueling in comparison with steam locomotives. Under ordinary working conditions one fueling of these "three-power" locomotives will be equivalent, in point of length of service, to six water and coal stops for a steam locomotive.

Each locomotive will be 47 ft. long, weigh 124 tons, all loaded on two four-wheel trucks, and develop 1,640 brake-horsepower, capable of hauling 45 loaded cars at a speed of 20 miles an hour, operated by trolley, and 8 miles per hour when operated by the oil-electric engine and storage battery.

The batteries will be of the highest voltage ever installed in a locomotive. Each will be of the "Exide" iron-clad type, containing 360 cells, weighing 28,000 lb., manufactured by the Electric Storage Battery Company. The oil-electric engines will be of the Ingersoll-Rand make, and the electrical apparatus will be supplied by the General Electric Company. These locomotives will be assembled at Erie, Pa., and delivery is expected early next summer.

Designed especially for main-line transfer and classification yard switching service, these "three-power" locomotives will be employed in the "tunnel run" service of the Lackawanna between its Hoboken-Jersey City terminal and its New York transfer at Secaucus, N. J.

Tacoma Takes Option on Four Water-Power Sites

Negotiations for the acquisition by the city of Tacoma, Wash., of additional power projects with an estimated total available capacity of 80,000 hp. have been revealed by Commissioner Ira S. Davisson of the city utilities department, and he has introduced an ordinance to appropriate $40,000 for engineering studies of the projects, besides obtaining approval of an option on certain properties until December 16.

Water rights, dam sites, reservoir sites and other rights and properties on the Duckabush River, the upper and lower Dosewallips and the Hamma Hamma River are included in this option, taken by the city from Elbert M. Chandler of Olympia, Wash., and the Hamma Hamma Power & Paper Company. The consideration asked is $370,000, $300,000 to go to the company named and $70,000 to Mr. Chandler. The properties are 30 miles from Tacoma. The largest development would be on the Hamma Hamma, for which an appropriation of 350 sec.-ft. of water has been asked. The construction of a dam across this river, 142 ft. high and 875 ft. long at the top, would make available, it is claimed, water storage of 15,800 acre-ft. The water would have a 480-ft. drop to Hood's Canal. On the lower Dosewallips, the upper Dosewallips and the Duckabush appropriations of 150 sec.-ft., 80 sec.-ft. and 50 sec.-ft. respectively have been asked.

Studies of the projects will be made under the direction of J. L. Stannard, chief engineer of the department.

Electricity Applied to Strip Coal Mining in Illinois

To see the most extensive application of electricity to strip coal mining that has yet been made more than a thousand people traveled by special train and automobiles from Chicago, St. Louis and other cities to the Fidelity Mine of the United Electric Coal Company, near Duquoin, Ill., on November 7. The principal attraction was an electric shovel said to be the biggest in the world, which is used for stripping the overburden of earth from the coal vein which is being mined.

The shovel was designed for use with a 20-cu.yd. bucket, but this size was reduced to 15 cu.yd. in order to permit an extension of the boom. The reach of the dipper is sufficient to place material about 85 ft. above the ground. The complete shovel weighs approximately 1,650 tons, about twice the weight of the largest previously built. The shovel is operated by one man by means of Ward Leonard control on the conversion equipment supplying direct current to the motor. The 4,000-volt alternating-current power supply drives a five-unit motor-generator set consisting of a 1,700-hp. motor, one 860-kw. generator, two 350-kw. generators and a 50-kw. exciter.

The equipment described and the drive motors on the shovel, as well as all other electrical equipment in the mine, was furnished by the General Electric Company. A very large tipple designed and erected by the Jeffrey Manufacturing Company serves seven railroad tracks and has a capacity of 800 tons of coal per hour. The tipple is operated by 43 electric motors in ratings ranging from 3 hp. to 150 hp. and aggregating approximately 1,000 hp. Nearly all are three-phase, 60-cycle machines operating on 440 volts, and with but few exceptions they are standard slip-ring induction motors. Virtually all are operated by magnetic push-button control.

Terminable Permit Law of Oklahoma Unconstitutional

The Supreme Court of Oklahoma determined on November 7 that the terminable permit act passed by the General Assembly in 1925 and bitterly fought by municipal authorities throughout the state is unconstitutional. Under this law utilities were permitted to surrender their municipal franchises and obtain from the state indeterminate permits which were subject to cancellation only by act of the Legislature of the state.

Most public utility companies whose franchises have expired since the passage of the measure have elected to operate under its provisions and have obtained the necessary permits from the State Corporation Commission. Since 1925 some of the utilities operating under the permit law have made voluntary reductions in rates. (See "Court Decisions," page 1001.)

Briefer News

NEW "WHITE WAYS" IN OHIO CITIES.—Two Ohio cities, Defiance and Middletown, have just dedicated new "white way" systems with elaborate ceremonies. The Middletown system extends more than one-half mile on Central Avenue, while the Defiance system covers the entire business section.

DELTA, COLO., VOTES AGAINST MUNICIPAL PLANT BY SMALL MAJORITY. — The franchise of the Western Colorado Power Company in Delta, Colo., expired early this year, the company continuing to serve without a franchise. In the election of November 5 the vote was 284 to 266 against building a municipal plant.

KANSAS POWER & LIGHT ENLARGING TECUMSEH PLANT.—The Kansas Power & Light Company has started construction of an addition to its Tecumseh power station east of Topeka which will increase the capacity of the plant from 27,000 kw. to 55,000 kw. and make it the second largest power station in Kansas. The addition will cost $1,500,000.

WANTS CUSTOMER PRESENT WHEN METER IS READ.—An unusual complaint presented to the Indiana Public Service Commission asks that meter reading shall take place in the presence of the customer if he so desires, together with the privilege of having meter tests made by experts employed by the customer at his option. The petitioner, a trade union lawyer, asks that a time for reading every meter be fixed monthly in advance and the customer notified.

POWELL RIVER COMPANY TO BUILD 32,000-HP. PLANT ON LOIS RIVER.—With assurance from the provincial government of British Columbia that its application for development rights on the Lois River will be granted, the Powell River Company is making plans to develop eventually 32,000 hp. on that stream and to install paper-making machinery there. The site is 10 miles distant from the company's present 50,000-hp. plant on the Powell. About half the new installation will be made in the near future.

CANADIAN TRANSFORMER STANDARDS AMENDED.—The Canadian Engineering Standards Association has just published the second edition of its standards for single-phase distribution transformers. The first edition was published in 1920. The capacity limit has been increased from 100 kva. to 200 kva., the former rated voltages of 2,200 and 4,400 have been changed to 2,300 and 4,600 with corresponding alterations in tap voltages, and a few additions have been made to the list of rated capacities. The association has avoided the inclusion of any provisions which cover the same ground as the standardization rules of the American Institute of Electrical Engineers, many of which have received wide acceptance in Canada. They have in fact been approved by the Canadian Engineering Standards Association so far as the rating and testing of transformers is concerned.

EXPANSION OF KANSAS CITY (KAN.) MUNICIPAL PLANT CONTEMPLATED.—Engineers acting for Kansas City, Kan., recommend the ultimate expenditure of $7,413,550 on extensions to the municipal lighting plant and that nearly $3,000,000 of that sum be spent immediately for the installation of a 25,000-kw. generating unit and boiler equipment. The program mapped out covers equipment to be purchased up to 1951, when the plant, according to these plans, should have a rating of 100,000 kw. A citizens' committee has approved the plans.

NARRAGANSETT COMPANY PUTS NEW SUBSTATION INTO SERVICE.—Better to serve the business and industrial center of Providence, R. I., the Narragansett Electric Company has placed in operation a new manually operated substation on Harris Avenue having an initial rating of 12,500 kva. Immediate enlargement of transformer facilities to 17,500 kva. will be made. Three 11-kv. underground cables tie the substation into the South Street generating station, and there are at present four 11-kv. and five 2,300-volt outgoing feeders serving important industrial and other loads. The initial installation cost about $500,000 and was designed and built by the New England Power Construction Company, affiliated with the New England Power Association, Boston.

FIGHT FAIRBANKS-MORSE MUNICIPAL PLANT IN IDAHO.—The Idaho Power Company and eight more taxpayers have intervened in a case recently carried to the State Supreme Court to prevent the officials of the city of Buhl from going ahead with a contract for putting up a municipal power plant. The new litigants seek to prevent sale of bonds for construction of a power distributing system and support the earlier demand that the city officials be prevented from entering a contract for $98,904 with the Fairbanks-Morse Company for installation of a Diesel-engine generating system. The power company claimed that its power resources are ample and its rules and rates reasonable.

MILWAUKEE COMPANY COMPLETES BOILER INSTALLATION.—The new high-pressure boiler installation increasing the capacity of the Lakeside power plant of the Milwaukee Electric Railway & Light Company has been completed. The additional boiler puts the steam capacity on a level with that of the generating equipment, which is 234,700 kw. The cost of the new installation, including auxiliary equipment and building extensions, was $1,500,000.

GOVERNOR OF MAINE REJECTS REFERENDUM PROPOSAL ON EMINENT DOMAIN FOR POWER COMPANIES. — Petitions undertaking to invoke a referendum on a law granting the right of eminent domain to electric power companies, enacted by the 1929 Legislature, have been rejected by Governor William T. Gardiner, on the ground that they do not meet the requirements as to validity. The Governor declares that the legislation concerned is therefore a duly enacted public law of the state.

SAVANNAH (GA.) RATES REDUCED.—An order issued by the Georgia Public Service Commission puts in force a reduced tariff for the Savannah Electric & Power Company effective with November meter readings. Under the old rate 9 cents net per kilowatt-hour was paid for lighting and 4 cents for power. Lighting and power rates are combined in the new rate structure. Five cents will be charged for the first 50 kw.-hr., 3 cents for the next 150 kw.-hr. and 2 cents for any excess. There will be also a service charge of $1 a month for a meter under 25 amp. and $2 for a larger one.

VIRGINIA UTILITIES ASSOCIATION PROGRAM.—Speakers on the program of the fourth annual convention of the Public Utilities Association of Virginia, to be held at Old Point November 21 and 22, include M. S. Sloan, president National Electric Light Association; Paul S. Clapp, managing director N.E.L.A.; Louis S. Epes, chairman State Corporation Commission; Louis I. Jaffe, editor *Virginian-Pilot*, Norfolk; Dr. J. A. Burruss, president Virginia Polytechnic Institute, and others. Group luncheons and women's sessions will be features.

MAINE'S NEW 110-KV. TRANSMISSION LINE BEING PUSHED. — The 110-kv. transmission line under construction from Gulf Island, Me., to a temporary substation at Westbrook, a distance of more than 32 miles, is progressing rapidly and will probably be completed about the end of the year. This line will afford better facilities for interchange of power between the Cumberland County Power & Light Company and central Maine. At first it will be

energized at 66,000 volts. It will be of H-frame construction, the minimum height of poles being 50 ft. There will be 378 structures with one steel switch tower at North Pownal.

West Texas Company Builds 225 Miles of Transmission Lines in Nine Months.—Since January 1 the West Texas Utilities Company has constructed more than 225 miles of high-tension lines extending over a territory to approximately 2,300 miles. One of the longest was between Sonora and Ozona, 36 miles. A line of the same length was completed between San Angelo, Christoval and Eldorado. Santa Anna and Cross Plains, nearly 30 miles apart, were connected by a 66,000-volt line.

Unusual Lighting for Airway from Portland to The Dalles, Ore. —An airway planned for the Columbia River gorge in Oregon will have a lighting system unique among such aërial thoroughfares. A line of beacons on each side of the gorge from Portland to The Dalles will supplement eight or ten 2,000,000-cp. beacons on islands in the river. One line of lights on islands in the center of the Columbia would not be possible on account of high water and ice hazards. No other airway, it is said, has this double lighting scheme.

Power Possibilities on South Fork of Stilaguamish River, Wash., and Clark Fork, Mont.—The potential power of the South Fork of the Stilaguamish River between Blackjack Creek and Granite Falls, Wash., amounts to 64,500 hp. for 50 per cent of the time or 58,100 hp. for 90 per cent of the time, according to a short report prepared by D. J. F. Calkins, a hydraulic engineer of the Geological Survey. Three sites proposed would develop the head between the 1,300-ft. contour and the 250-ft. contour. Five dam sites on Clark Fork, Mont., are described in a brief report by W. A. Lamb, a hydraulic engineer of the Geological Survey. The potential power at four of these sites at low water is estimated at 122,000 hp. at an efficiency of 80 per cent.

May Judge Who Is Utility Customer Hear a Suit Concerning Sought-for Rebate on Charges Paid? —A legal battle to settle the question of whether a judge who is listed as a customer of the utility in the territory affected by the litigation is qualified to preside in the trial of a suit for refund on electric rates has reached the Alabama Supreme Court from the Mobile Circuit Court. The issue developed in a suit of the city of Mobile against the Alabama Power Company for a refund on rates charged it for electric service in 1928. While not claiming that the judge would be directly affected by the outcome of the particular proceeding before the court, counsel for the power company argued that the case constituted a test of the rate refund question and that by reason of the fact that he was a customer of the company he would have equal right with any other consumer of electricity in Mobile to apply for a refund on the rates if the municipality should ultimately win its suit. If the contention of the power company is upheld by the Supreme Court, none of the three circuit judges in Mobile will be eligible to hear the suit, since all are consumers of electricity supplied by the utility.

New Transmission Line Helps West Virginia Towns.—All the electric power resources of the Monongahela-West Penn Public Service Company and associated companies became available for Sutton and Gassaway, W. Va., when the new power transmission line to those towns was cut into service on November 1. A transmission line was constructed from Weston to Gassaway, connecting with a line from Sutton. At Weston there is connection with a line from the substation at Clarksburg, which is fed from the company's power station at Rivesville, near Fairmont.

Nebraska Company Extending Transmission System.—The Western Public Service Company, with headquarters at Scottsbluff, Neb., has received authority from the Nebraska State Railway Commission to reconstruct a number of transmission lines, to increase voltage on others and to build links that will make it possible to connect its lines in a complete circle. It recently purchased small plants in several counties in the north Nebraska sandhill country and is planning to run a long line that will connect these plants with its plants in western and central Nebraska.

Coming Meetings

[A complete directory of electrical associations, with their secretaries, is published in the first issue of every volume. For latest list see issue of July 6, page 46.]

Public Utilities Association of Virginia—Chamberlin-Vanderbilt Hotel, Old Point, Va., Nov. 21 and 22. A. B. Tunis, 306 Grace Securities Bldg., Richmond, Va.

National Electrical Credit Association—Central Division, Palmer House, Chicago, Nov. 21 and 22; New York Division, Hotel Pennsylvania, New York City, Dec. 10; New England Division, University Club, Boston, Jan. 21. F. P. Vose, 1008 Marquette Bldg., Chicago.

American Institute of Electrical Engineers—District meeting, Chicago, Dec. 2-4; winter meeting, New York, January 27-31. F. L. Hutchinson, 33 West 39th St., New York.

American Institute of Mechanical Engineers—New York, Dec. 2-6. C. W. Rice, 29 West 39th St., New York.

American Society of Refrigerating Engineers—New York, Dec. 4-7. D. L. Fiske, 37 West 39th St., New York.

Empire State Gas and Electric Association—Electric Section, Briarcliff Manor, N. Y., Dec. 5-6. C. H. B. Chapin, Grand Central Terminal, New York.

American Engineering Council—Washington, Jan. 9-11. L. W. Wallace, 26 Jackson Place, Washington, D. C.

North Central Division, N.E.L.A.—Commercial Section, St. Paul Hotel, St. Paul, Jan. 20-21; Engineering Section, Nicollet Hotel, Minneapolis, Feb. 24-25. J. W. Lapham, 803 Plymouth Bldg., Minneapolis.

National Electrical Wholesalers' Association—Pacific Division, Del Monte, Calif., Jan. 31-Feb. 1.

Utility Companies Help Department of Commerce in Drafting Air Maps.—The New York Power & Light Corporation and other Mohawk-Hudson subsidiaries have just completed a series of maps upon which have been indicated all tall company structures within their territory on the airways between Buffalo and Albany and Albany and New York City. The work has been done by the company's engineering department in co-operation with the New York Commission on Aviation and will be presented to the United States Department of Commerce for incorporation into government air maps.

London, Ohio, in Muddle Over Electric Service.—The matter of supplying electric light and power to London, Ohio, is to be threshed out by the Court of Appeals. The muddle arose from the granting by the London City Council several months ago of a franchise to the Ohio Edison Company, Springfield, after months of legal battle between the London Light & Power Company, an Ohio Edison ally, and the Central Utilities Corporation. Following the franchise grant initiative and referendum petitions were filed. One petition called for a vote on permitting the Central Utilities Corporation to serve London and the other for a vote on the franchise to the Ohio Edison. Both petitions were overruled in court and the matter was referred to the higher judicial body.

Public Service of Colorado to Add to Its Equipment.—The largest budget ever contemplated by the Public Service Company of Colorado for improvement and rehabilitation has been announced by Clare N. Stannard, vice-president and general manager, who said that on October 29 his company carried a peak load of more than 1,000,000 kw.-hr. A heavy percentage of this increased business falls on Valmont, the company's 65,000-hp. steam generating plant near Boulder, and a boiler costing half a million dollars will be added to the Valmont equipment. Addition to outlying hydro and steam plants and an ambitious program on high-voltage tie lines are other items. Total expenditure by the company in the near future is put at $4,673,000, but this includes outlay for the supply of natural gas.

Output of Seattle Municipal Hydro Plant Lessened by Long Drought.—The Seattle City light department has applied to the City Council for an additional appropriation of $200,000 to operate its Lake Union steam plant and to purchase electricity from Tacoma for the remainder of the year to make up a deficiency in the output of Skagit River and Cedar Falls hydro-electric plants due to unprecedentedly low water. The appropriation

sought, with extra allowances previously voted, will bring the actual cost of these operations and purchases to about $550,000, or approximately $300,000 in excess of the department's estimate for 1929. The protracted drought, with resultant low water flow in the Skagit River and at Cedar Lake, has resulted in operation of the Lake Union steam plant night and day for some time and also in buying all the power that the city of Tacoma can spare from its Lake Cushman plant.

NEW OFFICE BUILDING AT BAY CITY FOR CONSUMERS POWER COMPANY.—Plans for a three-hundred-thousand dollar office building to be erected at Bay City, Mich., have been announced by the Consumers Power Company. To be started soon after the first of the year, the structure will be three stories high.

COMPANY AND CITY IN FIGHT AT SALEM, MO.—An active war is going on at Salem, Mo., a place of 1,800 inhabitants, between the Missouri General Utilities Company and the city administration. The company's franchise expired last January, the city having refused to renew it, and the utility has continued to serve its customers without one. The city installed a plant, to be paid for out of earnings, and so far furnishes 40 per cent of the electricity used in Salem, the company furnishing 60 per cent. The city has now ordered the company to remove its poles and wires within 90 days, and the company, which will probably contest this order in the courts, has responded by cutting its top rate from 15 cents for the first 50 kw.-hr. a month to 13 cents for the first 25 kw.-hr., stepping down to 10, 8 and 6 cents. The Missouri Public Service Commission, confronted with a novel question so far as it is concerned, has postponed the operation of the company's new tariff pending investigation. (See Commission Rulings," on this page.)

NORTHERN STATES POWER COMPANY ATTACKED BECAUSE OF ITS ST. CROIX RIVER DAMS.—Charges of causing interference with navigation and the destruction of fish were made against the Northern States Power Company at a recent meeting of the St. Croix River Improvement Association, which is trying to bring pressure on the War Department to survey the river and deepen the channel. The power company is charged with non-observance of law in the use it makes of the Nevers and St. Croix Falls dams. Asked about these charges, Vice-President Robert F. Pack of the company said: "We are operating the St. Croix Falls dam according to permit and regulations of the War Department. When the government engineers get to looking into the situation I think they will find that something should be done to improve the condition of the channel between Taylors Falls and Stillwater. But the cause of present conditions is that there has been a very low stage of water in the St. Croix for the past few years, and I believe that if it were not for our dam at St. Croix Falls, conditions in the river below would be worse than they are now."

RATES OF SOUTHERN SIERRAS POWER COMPANY REDUCED. — Rates of the Southern Sierras Power Company have been reduced approximately $300,000 a year by the California Railroad Commission in an order issued on the application of that company for a revaluation of its properties and an adjustment of its rates, filed more than four years ago. The new rates will be effective December 1. While awaiting a decision the company made four voluntary reductions, amounting to $175,000, $90,000, $2,000 and $5,000 respectively. The present reduction amounts to approximately 14 per cent in the domestic and commercial lighting schedules on the system as a whole, but the Imperial Valley area will benefit much more than elsewhere. The rates in the competitive area of the utility are not altered, as they are the same as those of the Southern California Edison Company. This area is roughly San Bernardino, Riverside and Arlington. The reduction in its northern division is approximately 10 per cent.

Recent Court Decisions

INDETERMINATE FRANCHISE FOUND UNCONSTITUTIONAL IN OKLAHOMA.—The Supreme Court of Oklahoma has held, in City of Okmulgee vs. Oklahoma Natural Gas Corporation, that the revocable permit law of 1925, permitting public utilities to surrender a municipal franchise and obtain a permit from the state that was revocable only by legislative action, is unconstitutional. Three grounds for this ruling are given. The first is that the act authorized the conversion of a limited franchise into a perpetual franchise, in violation of a section of a constitutional prohibition against perpetuities and monopolies. The second is that the act deprives the electors of a municipality of their right to grant, renew or extend a franchise, which right is reserved to the people in the constitution. The third is that the act deprives 25 per cent of the electors of a municipality from presenting a petition demanding that a public utility franchise be granted, renewed or extended.

CALIFORNIA DAM INSPECTION ACT UPHELD.—The constitutionality of the California dam inspection act, passed by the 1929 Legislature, has been upheld by the Third District Court of Appeal in a decision handed down in favor of Bent Brothers, Inc., contractors who are building the flood-control dam on the Calaveras River for the city of Stockton. Bent Brothers had petitioned for a writ of mandamus to compel J. P. Campbell, city auditor, to issue a warrant for $70,724 in their favor to cover work done by them under revised plans as ordered by Edward Hyatt, state engineer, under authority of the state dam inspection act. The court ordered the writ issued, declaring the act to be "not only a proper but a necessary exercise of the police power of the state in the interest of protecting life and property." The court pointed out that while the state engineer has not the right to impair the obligations of contractors, "he can maintain suits to prevent the contract being so performed as to create a menace to life and property."

Commission Rulings

COMPANY COMPETING WITH MUNICIPAL PLANT ORDERED TO RESTORE RATES.—On complaint of the City Council of Salem, Mo., where the Missouri General Utilities Company, operating after the expiration of its franchise, has cut its electric rates to a point below those of a newly established municipal plant, the Missouri Public Service Commission has ordered the company to maintain its rates on the old schedule, which is the same as that adopted by the city, for 120 days, pending investigation by the commission of the reasonableness of the new tariff. The city asserted that the company, which it has ordered to remove its poles and wires from the streets within 90 days, cut its rates after previous refusals to do so for the purpose of making the municipal plant unremunerative and hampering the city in its plan to pay for the plant in monthly installments out of earnings. In its order the commission said: "The commission is of the opinion that these grave charges should be investigated to the end that the company be not permitted to install non-compensatory rates, thereby causing this property to become a burden on the other plants of said company." Commissioner Ing filed a dissenting opinion in which he maintained that the company's customers should be allowed the benefit of the new rates until the commission reaches its final decision in the case.

LOUISIANA COMMISSION PERMITS RATES BELOW SCHEDULE TO ATTRACT NEW INDUSTRIES NOT COMPETING WITH ANY ESTABLISHED.—Provided that new industries invited to any city do not compete with any already established there, public utility companies in Louisiana may now make special rates for them below those charged previous customers. This decision has been made by the Louisiana Public Service Commission in a case where gas was the commodity and the Southwestern Gas & Electric Company and the city of Shreveport were concerned. The commission said: "Realizing that the legality of such an order is based largely upon the acquiescence therein by the utility, authority will be granted the distributing company for a period of one year after the date of this order, with the approval of the commission, to sell gas to any such new industries which may locate within the city of Shreveport and the town of Bossier City and/or their environs, at rates below those provided in the schedule applicable only to manufacturing and industrial consumers, provided, however, that no such rate shall be granted to any new industry which may engage in a business competitive with any industry at that time or then operating within the city of Shreveport and/or the town of Bossier City and/or their environs and being at that time served by the utility. The authority to determine whether such prospective consumer is a competitor of any such existing industry is to be under the jurisdiction of the Louisiana Public Service Commission."

News About Men of the Industry

Samuel Insull Celebrates Seventieth Birthday

© Samuel Insull

Samuel Insull, president of the Commonwealth Edison Company, Chicago, commemorated his seventieth birthday anniversary on November 11. Flowers and messages of congratulation were received by Mr. Insull from his many personal friends and business associates who remembered the day. Mr. Insull observed the occasion by spending eight hours in his office, working harder than usual, and by attending the opening of the new Civic Theater in the Chicago Civic Opera House in the evening.

When Mr. Insull first came to this country, in 1881, he became private secretary to Thomas A. Edison and represented that distinguished gentleman in the organization and management of the Electric Tube Company, Edison Machine Works and the Edison Lamp Company. He built and operated for Mr. Edison the Edison Machine Works at Schenectady, N. Y., as general manager, and in 1889, when the various Edison manufacturing companies, together with the Edison Electric Light Company, were consolidated into the Edison General Electric Company, he was made second vice-president in charge of manufacturing. When that company was consolidated with the Thomson-Houston Company to form the General Electric Company he remained. It was in the year 1892 that Mr. Insull removed to Chicago as president of the Chicago Edison Company, where he has since been the dominating personality in the utility industry. At the present time, in addition to being president of the Commonwealth Edison Company, he is chairman of the board of the Public Service Company of Northern Illinois, Middle West Utilities Company, and head of various other utility enterprises.

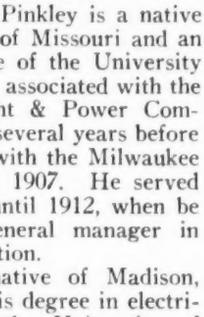
GEORGE E. NELSON, who has been connected with the Michigan division of the National Lamp Works of the General Electric Company for the past ten years, with headquarters in Detroit, has been appointed general manager of the northern division of the National Lamp Works with headquarters in Minneapolis.

JACK G. HOLTZCLAW was elected president of the Virginia Electric & Power Company at a meeting in New York of the directors of Stone & Webster, Inc., which owns the Richmond utility. J. FRANK MCLAUGHLIN, who on September 25 succeeded William E. Wood as head of the Virginia company, has been elected vice-president of the Stone & Webster Service Corporation in Boston.

Milwaukee Electric Elects New Vice-Presidents

R. H. Pinkley and G. G. Post have been appointed vice-presidents of the Milwaukee Electric Railway & Light Company. The new officials are veteran employees of the company, having been advanced from minor positions to their present offices. In addition to becoming vice-president, Mr. Pinkley will retain his former title of assistant general manager and will continue to direct the company's transportation activities. Mr. Post has been designated vice-president in charge of power, succeeding the late John Anderson. Mr. Pinkley is a native of Missouri and an engineering graduate of the University of Missouri. He was associated with the Union Electric Light & Power Company, St. Louis, for several years before becoming identified with the Milwaukee Electric company in 1907. He served as chief draftsman until 1912, when be became assistant general manager in charge of transportation.

Mr. Post is a native of Madison, Wis., and received his degree in electrical engineering at the University of Wisconsin in 1904. For two years immediately following his graduation he was an instructor in electrical engineering at the university. He entered the service of the Milwaukee Electric company in 1906 as assistant to the electrical engineer of the lighting department. Later he became superintendent of electrical testing and then electrical engineer in charge of the electric distribution department. Mr. Post has become a widely known authority in the electrical industry on power plant and electric distribution problems and has served on a number of regional and national committees studying technical problems. In his new position he will direct the design, construction and operation of the company's proposed new power plant at Port Washington and the enlargement of the Lakeside plant, now under way.



H. B. Bryans New Vice-President in Philadelphia

Henry B. Bryans, who was elected vice-president of the Philadelphia Electric Company, as announced in the November 9 issue of the ELECTRICAL WORLD, has been connected with the public utility industry in Pennsylvania for a number of years. He started in the gas branch of the industry and in 1910 he became engineering assistant with the Fulton County Gas & Electric Company of Gloversville, N. Y. Later he was named engineer and served for a short time as acting manager before transferring his interests to the United Gas Improvement Company. He remained with the U.G.I. organization from 1912 to 1914, when he was appointed engineer of the Schuylkill district of the Counties Gas & Electric Company, Norristown, in charge of gas and electric operations. Subsequently he served as general superintendent of the Philadelphia Suburban Gas & Electric Company and the Counties Gas & Electric Company and after the merger of these companies into the Philadelphia Suburban-Counties Gas & Electric Company he continued in the capacity of general superintendent. In the fall of 1928 he was elected assistant general manager of the Philadelphia Electric Company and assumed similar duties with the Philadelphia Suburban-Counties Gas & Electric Company. In the course of his career Mr. Bryans has engaged in various association activities for the Pennsylvania Electric Association, the Pennsylvania Gas Association and the National Electric Light Association, having done extensive committee work for these organizations and having contributed papers to their proceedings and to those of civic and similar organizations.

ROBERT B. GROVE, secretary and assistant to the vice-president and general manager of the United Electric Light & Power Company, New York, has been appointed by Matthew S. Sloan, president of the National Electric Light Association, to serve as general traffic manager of the N.E.L.A. for the 1930 convention to be held at San Francisco. During the 1925 convention, also held in San Francisco, Mr. Grove served as Eastern traffic manager. This year he has complete charge of all transportation arrangements throughout the United States and Canada and will be responsible for all movements of the 3,500 to 4,000 delegates.

H. H. Kerr in Toledo

Harry H. Kerr, formerly superintendent of the electric department of the Public Service Company of Colorado, has been appointed superintendent of the electrical operating department of the Toledo Edison Company. The continued growth of the Toledo Edison Company over the past few years has made necessary the addition of an operating executive and also the division into two departments of what formerly has been one. In conformity with good operating practice as it is employed by other large companies, the electrical engineering department and the electrical operating department have been separated, with G. W. McIver chief engineer and H. H. Kerr superintendent of the electrical department.

Mr. Kerr is a Texan by birth and was educated in the University of Colorado, where he won his degree in electrical engineering in 1914. He then went to the General Electric Company on the test course and to the Doherty training school in Denver. Finishing the training course of Doherty junior engineers he was transferred to Warren, Ohio, to the Trumbull Public Service Company, but it was not long before the Denver company found need for his services again, and for two years Mr. Kerr served as construction engineer on the new plant in Denver.

S. B. Tuell Appointed to New Executive Duties

Samuel B. Tuell, who was elected president of the General Public Service Corporation, as announced in the November 9 issue of the ELECTRICAL WORLD, has been identified with the Stone & Webster interests since 1902. In the course of his career he served in various capacities with operating companies under that management and prior to removing to New York in 1926 was district manager of Stone & Webster properties in the Middle West. Mr. Tuell became vice-president of the Engineers Public Service Company three years ago. In addition to his duties as an executive of these two companies he serves on their directorate and is a member of the board of directors of the Gulf States Utilities Company, El Paso Electric Company, Western Public Service Company and other operating companies. Mr. Tuell has been active in the National Electric Light Association, being a past-president of the Michigan Electric Light Association. Monuments to his work in Colorado are the central Lacombe plant in Denver and the Valmont plant near Boulder.

O. G. MARTINO, for many years commercial manager of the Eastern Shore Public Service Company, has just been placed in charge of Empire Public Service Corporation operations in Maryland, Delaware and Virginia.

Obituary

Guido Semenza

Guido Semenza, eminent Italian engineer, died suddenly November 7 in Italy after a long illness. For many years Mr. Semenza had been an international figure in engineering circles, having served in a consulting capacity for many Italian companies, as well as for various organizations in foreign countries, including Switzerland, England, Belgium, Russia, South America and the United States. He was one of the founders of the Associazione Elettrotecnica Italiana and occupied the presidency of that association from 1915 to 1917. He was also one of the founders of the International Electrotechnical Commission, to which he had given generously of his time and advice since its inception. For many years he was president of the Italian Electrotechnical Committee, and in 1923 became president of the I.E.C., entering actively and enthusiastically into the work of the commission and developing its activities in many new fields. It will be recalled that in 1921 he acted as president of the commission sent to the United States by a group of electrical societies and financial interests to study the most recent electrical developments and to endeavor to interest American capital in Italian enterprises. He won recognition for his scientific achievements outside of his native country, having been awarded the Faraday medal by the British Institution of Electrical Engineers early this year and having been appointed an officer of the French Legion of Honor the preceding year.

Mr. Semenza was born in London of Italian parentage. He returned to Italy at an early age, obtaining his early education in that country and later receiving his degree as industrial engineer at the Polytechnic School in Milan and another degree in electrical engineering at the Institut Montefiore in Liege. Following the completion of his technical studies he became associated with the Edison Company in Milan when that company was formulating plans for the Paderno plant, the pioneer hydroelectric plant in Europe. He assumed the supervision of the electrotechnical construction of this plant and also directed the construction of the high-tension transmission line to Milan. He remained with the company as chief electrical engineer up to the year 1917. During his connection with the Edison Company his services as a consulting engineer were frequently sought by other companies and he became one of the principal consulting engineers of his country. One of the last acts of Mr. Semenza's life was the cabling of a message of appreciation of the late John W. Lieb.

Mr. Semenza published many original scientific studies, among them being the extension given by him to the Kelvin law for the calculation of conductors, graphical tables for overhead line construction, and many studies on towers for transmission lines. He was honorary president of the International Electrotechnical Commission, vice-president of the International Commission on Illumination and of the Conference des Grands Reseaux, and for many years had been honorary secretary for Italy of the American Institute of Electrical Engineers and of the Institution of Electrical Engineers (British).

CURTIS C. COOK, formerly secretary of the Hartford Electric Light Company, Hartford, Conn., died suddenly October 30 following a heart attack. Mr. Cook was 55 years old and was a native of Hartford. He became connected with the Hartford Electric Light Company in 1892, became secretary in 1899 and was later named assistant treasurer. Mr. Cook resigned all connections with the company in 1909. He has since been connected with real estate interests and was a director of several organizations.

CHARLES S. LAWSON, assistant manager of the transformer engineering department of the Sharon plant of the Westinghouse Electric & Manufacturing Company, died October 12 following an operation. A graduate of the Massachusetts Institute of Technology, Mr. Lawson became associated with the Atlanta Water & Power Company following the completion of the student course of the General Electric Company. In 1905 he joined the transformer engineering department of the Westinghouse Electric & Manufacturing Company at East Pittsburgh as insulation engineer, later becoming assistant manager. He had been in Sharon since 1925. Mr. Lawson was a fellow of the A.I.E.E.

Financial and Statistical News

TEN LEADING UTILITY STOCKS listed on the New York Stock Exchange reached a point, on November 12, 60 per cent, on the average, below the year's high. The average price was 73, against 183.

——ILLUSTRATING THE UNREASONABLY LOW LEVELS to which utility issues have been pushed American Gas & Electric common sold as low as 70 from a high this year of 224⅞. Last year the company earned $7.94 on common, and one may assume this year's earnings are up substantially. Even on 1928 earnings yesterday's low price was less than nine times earnings.

THE EQUIPMENT STOCKS ALSO HAVE LOST between 50 and 60 per cent from their high levels for the year. Westinghouse sold as low as 102⅝, against a high of 292⅝, and General Electric 168⅛, against 403.

Columbia Gas Increases Capitalization

At the recent meeting of the shareholders of the Columbia Gas & Electric Corporation the increase of the authorized common stock without par value from 10,000,000 shares to 30,000,000 shares was approved. The board of directors also declared a 25 per cent dividend on the common stock, payable in common stock on March 31, 1930, to shareholders of record at the close of business February 28, 1930. On Wednesday the company deferred payment of the second installment of shares recently acquired under rights granted by the company according to an announcement made by the executive committee.

Court Makes Sharp Cuts in Telephone Valuation

In view of the valuation principles involved, the sharp reductions in previous valuations made by the federal statutory court in New York State telephone properties are of interest to the utility field. The court made the following reductions, totaling over $70,000,000, on a previous court valuation under Special Master Oeland of $518,109,584, while the company claimed valuation of $727,000,000: Inexperience factor, $17,393,214; going value, $25,000,000; cost of financing, $22,943,109; bankers checking engineers, $2,207,000; interest on preliminary costs, $2,554,763; total, $70,098,086.

The court rejected the master's approval of the company's claim that if the property were reproduced, an inexperienced firm would charge $17,000,000 over actual cost. It cut down the finding of $35,000,000 for going value to $10,000,000 and eliminated the entire amount of almost $23,000,000 approved of by the master for cost of financing. It cut out over $2,000,000 for bankers' checking engineers. It struck out $2,000,000 for interest on preliminary costs. These items alone total more than $70,000,000. The total disallowance amounted to more than $120,000,000. The largest single deduction was $60,000,000, representing the difference between the depreciation reserve and the alleged actual depreciation allowed by the master.

Since the telephone business is a monopoly, the court said, and affords a safe and fruitful field for investment, a return of 7 per cent rather than 8 should be adequate.

Four Frequencies in Italy

A multiplicity of frequencies is revealed by statistics recently published by the Italian Government, showing the rating of electric light and power substations, as follows:

Cycles per Second	Kva.
16⅔	234,500
42	1,167,500
45	426,500
50	1,195,500
Total	3,024,000

The total number of light and power establishments in 1928 was 1,866. Of these, 106 were producers, 621 distributors and 1,139 mixed. Most of them are evidently quite small; 404 are stock companies capitalized at less than 1,000,000 lire ($52,600); 1,080 are owned by individuals. The total capital is about 9,300,000,000 lire ($470,000,000).

Foshay Companies to Remain in Operation

Public utility properties allied with the W. B. Foshay Company, which went into receivership, as announced in the November 9 issue of the ELECTRICAL WORLD, will continue operations, according to a statement made by Joseph Chapman, receiver for the Foshay companies. The properties, scattered in various states of the United States, in Alaska, Canada and Central America, were in sound condition, he said. Overhead costs of the organization have been reduced $500,000 a year through the curtailment of activities at the headquarters in Minneapolis and in the twenty sales offices throughout the country.

North American Refuses to Extend Time for Rights

Officers and directors of the North American Company announced on Wednesday that they had concluded that it was not to the best interest of the stockholders to extend the rights beyond the original expiration date of November 15. The stock closed that day at 69 on the New York Stock Exchange, whereas the rights were granted to stockholders of record of October 17 to purchase one additional share for each ten shares at $100 a share, payable in full on November 15 or in four installments beginning on November 15 and ending on July 1, 1930. The statement issued by Frank L. Dame, president, yesterday said the officers and directors "have given careful consideration to the question of extending the rights to subscribe to common stock offered under date of September 24 and expiring November 15, 1929. At the time the offering was made the rights were of substantial value to the stockholders. With the change in market conditions they have recently had a very small value and that only for speculative purposes.

Electric Utility Values Not Shaken, Babson Man Says

Fundamental values remain unshaken in electric public utilities despite the stock market crash, declared Creighton J. Hill of the Babson Statistical Organization on Thursday at an all-day meeting of the Public Relations Section, New England Division, National Electric Light Association, in Boston.

"Do not let the events of the past few weeks upset the long and patient campaign of education in behalf of customer ownership which power companies have been conducting in all parts of the country in recent years," the speaker urged. "Henceforth earnings and yields will be the guiding factors to which the investor will look in selecting securities. Public utilities will continue to expand. The savage hammering which such stocks have received in the recent market crash was a matter involving quotations and not essential values. The long-term outlook for public utilities is today brighter than it has ever been in the history of the industry. A steady increase in power business is inevitable. The industry has little to worry about in terms of fundamentals."

Industrial Activity Holds at High Rate

MANUFACTURING operations of the country in October based on consumption of electrical energy were about 0.8 per cent under those of September, but were 3.9 per cent above October, 1928, according to reports received from more than 3,600 manufacturing plants by the ELECTRICAL WORLD.

Four of the primary manufacturing groups—chemical products, paper and pulp, rubber products and textiles—increased their rate of activity during October as compared with September. On the other hand, seven manufacturing groups—food products, rolling mills and steel plants, ferrous and non-ferrous metal working plants, leather products, lumber products, automobiles, including the manufacture of parts and accessories, and stone, clay and glass—reported a drop in rate of activity as compared with September.

Comparing current operations with those at this time last year, four manufacturing groups reported a drop, one was the same and six groups reported an increase over last year.

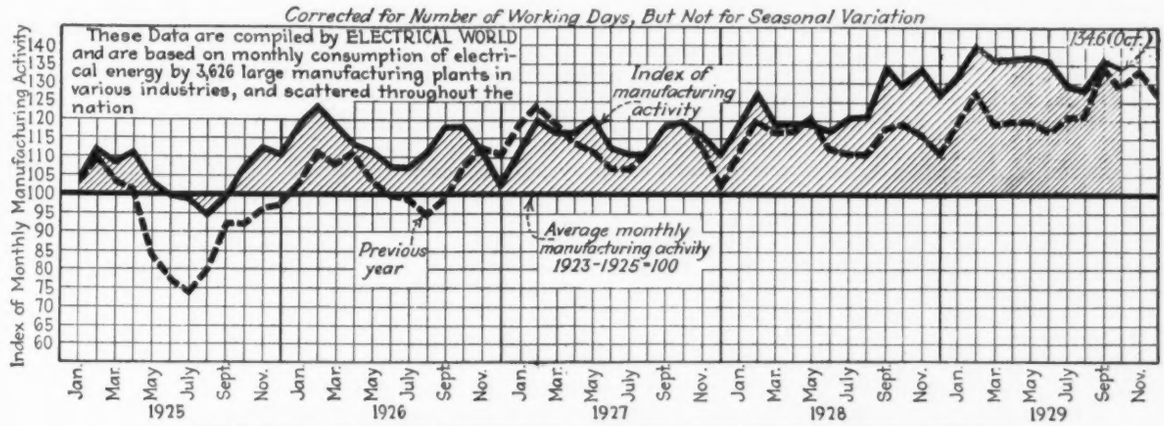
Three sections of the country report a rate of October operations over those of October, 1928—New England, 5.8 per cent; Middle Atlantic States, 0.8 per cent, and Southern States, 1.2 per cent. The North Central States reported a drop of 2 per cent and the Western States a drop of 1.6 per cent as compared with October last year.

For the fourth consecutive month the automobile industry, including the production of parts and accessories, reported a rate of operations under that of the same month last year, the rate of operations during October decreasing by 13.3 per cent compared with October, 1928. The October rate of activity in this industry was the lowest recorded since December, 1927.

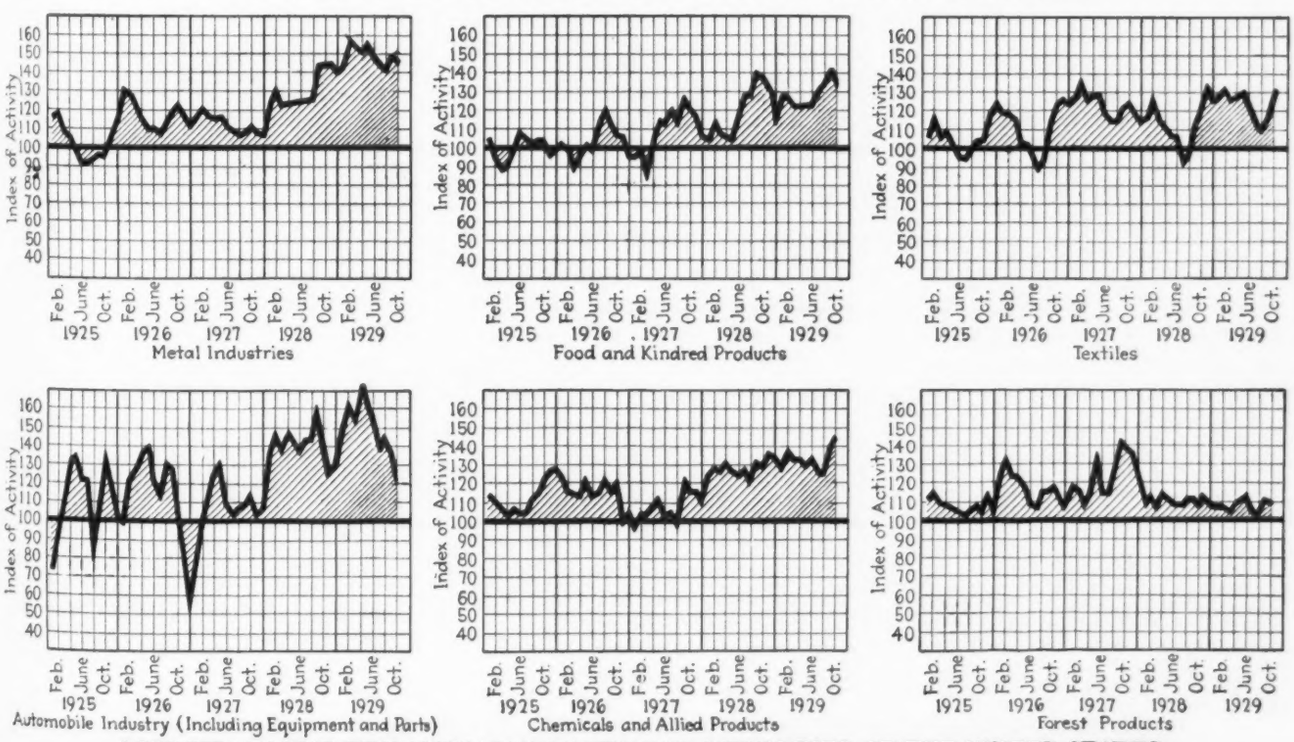
Consumption of electrical energy by ferrous and non-ferrous metal working plants during October was at a rate about 1.6 per cent under September, but was still 11 per cent above the consumption of energy by the same plants in October last year. This manufacturing group has maintained a very high rate of operations throughout the year and shows no signs of material curtailment during the remaining two months.

The textiles industry appears to have witnessed a material increase in activity during October. The October rate of operations in these plants was 12.3 per cent above September and 7.3 per cent above October last year. This is the highest rate of October activity ever witnessed by this industry.

UTILITY TO PAY FOR IMPROVEMENTS IN STOCK.—The Missouri Public Service Commission has authorized the Missouri Power & Light Company to sell to the North American Light & Power Company 3,000 shares of $6 cumulative preferred stock and 17,000 shares of common stock. Both are non-


Corrected for Number of Working Days, But Not for Seasonal Variation
These Data are compiled by ELECTRICAL WORLD and are based on monthly consumption of electrical energy by 3,626 large manufacturing plants in various industries, and scattered throughout the nation
134.6(Oct.)
Index of manufacturing activity
Previous year
Average monthly manufacturing activity 1923-1925=100
Index of Monthly Manufacturing Activity
1925
1926
1927
1928
1929

GENERAL MANUFACTURING ACTIVITY IN THE UNITED STATES



ACTIVITY IN THE PRIMARY MANUFACTURING INDUSTRIES OF THE UNITED STATES

par. The preferred will be sold at $95 a share and the common at $30. The order of the commission stipulates that if there is any profit made by the North American Light & Power Company in the resale of the securities this profit must go to the Missouri Power & Light. The proceeds of the sale will be used to repay the company for capital expenditures on improvements. North American Light & Power owns all outstanding stock of the Missouri company.

Give State Regulation a Trial!

Utility Executive Warns Association of Edison Illuminating Companies That Federal Legislation Will Otherwise Be Introduced

"THERE is an old saying that coming events cast their shadows before them. If this applies also to matters of legislation, the electric utility industry is facing a period of political attack and investigation, out of which new questions of public policy and new laws may well issue. The public press and magazines contain many items not of a friendly tone, carrying the implication that there is something wrong with the power industry and its relations to the public. Sundry pamphlets and books point out signs of federal encroachment on the powers of the states to regulate and proclaim that a crisis exists." Thus William J. Hagenah, vice-president of the Byllesby Engineering & Management Corporation, introduced an address recently before the Association of Edison Illuminating Companies.

The favorable aspects of existing state regulation are first stressed. Under the caption "Public Benefits Under State Regulation," Mr. Hagenah summed up the advantages arising out of the existing regulatory system. He placed as foremost adequacy of service, which not even the critics of the utilities will deny. The matter of electric rates is discussed in relation to prices of commodities and is shown to have declined in the face of the rise in all other prices.

It is also shown that there is no overcapitalization in the electric utility field, since effective state regulation makes capital inflation among the operating companies impossible. A comparison of the book cost of the leading electric and joint gas and electric utilities as built up under the commission prescribed classification of accounts and the par value of the securities issued against these properties shows the following:

Operating utilities deriving over 95 per cent of their gross earnings from electric service (179 companies)	
Book cost of properties	$4,788,761,902
Capitalization (par value)	4,506,120,171
Excess of book cost	282,641,731
Per cent of excess	6.6
Operating utilities associated with gas or railway utilities deriving from 60 per cent to 95 per cent of their gross earnings from electric service (74 companies)	
Book cost of properties	$3,714,748,789
Capitalization par value	3,735,802,229
Excess capitalization	21,053,440
Per cent of excess	0.6

These 253 companies represent over 80 per cent of the total investment in operating electric utilities and practically all of their electric property has been constructed or reconstructed since the beginning of state regulation.

Discussing the holding and management companies, Mr. Hagenah points out that every contact between the holding company and its operating subsidiaries is subject to the closest scrutiny under existing utility laws, and that in most states the commissions already have ample power to protect every public interest. It is also shown that the benefit accruing to the public in the form of service extensions to thousands of small communities, the improvement in service already furnished, the standardization of methods, increased efficiency of management and reductions in rate are matters of public record. "The management company provides each locality with managerial service superior to what a single plant could command, and generally at lower cost than independent management. It brings together and maintains a permanent staff of trained engineers, lawyers, accountants and rate experts, specialists in the various phases of utility management, who pass on the problems of each local utility that the company controls, constantly studying its needs, so that the best operating results to public relations may be obtained." With regard to the recent tendency to concentrate management and control, it is shown that this is not a feature especially of the utility industry, but is common to the leading industries of the country.

Repudiation of Bonds Results

After making a thorough analysis of the various attempts which have been made by the several states to undertake private enterprise, which ended in the repudiation of the bonds issued and the collapse of public credit, Mr. Hagenah proceeds to show the disadvantages of further federal regulation, even if it were practical. In the first place, there is practically no interstate question arising. The federal control, if it were instituted, would affect only about 10 per cent of the total production of power. Even this power is used largely for local business. Mr. Hagenah finds that the extention of state regulation presents the most feasible and practical solution of the problem and concludes:

A study of the criticism of the utilities and of state regulation draws attention to the wisdom of perfecting the existing system of regulation before turning from it to another. Much of the subject matter out of which such criticism now grows can be corrected by strengthening the state regulatory machinery to make certain that the economies resulting from scientific management are not withheld from the public. When it can be established that there are dangerous tendencies in the utility field no one will oppose truly corrective changes in the regulatory laws.

If state regulation lacks force in some states at this time, let the laws be so amended that the commissions will have the power to act whenever public needs arise, and let the enforcement of these laws be given to competent men who can regulate wisely and justly. An enlargement of the staffs and facilities of many of the commissions is necessary to increase their effectiveness under present conditions. Additional legislation in some states and amendments to existing laws in others should also be sought, to the end that greater uniformity may be attained in the important phases of regulation. Criticism of state regulation loses much of its sincerity when some states refrain from giving their commissions the authority and facilities necessary to render the most effective service to the public.

Again, the best results cannot be expected from state commissions under situations that impose on the members duties and responsibilities comparable with those of the highest judicial officials of the state, but providing compensation that in some states is no more than the earning of building tradesmen and factory artisans. State regulation has not reached its full capacity for service and for safeguarding public interest so long as seven states give their commissions no power to regulate the electric industry or 26 state commissions are without regular authority powers in matters pertaining to utility mergers, or 26 commissions have no power over contract rates, and seven cannot prescribe any electric rates, or 22 commissions have no authority over the issuance of utility securities, and ten states pay their commissions the salary of $300 per month or less. If there is any shortcoming in the effectiveness of state regulation, it is due in part, at least, to the failure of the states to exercise their rights and to perform their duties. When these matters are properly adjusted, as they will be when the subject is correctly understood, the utility commissions will serve the public even better than they have done in the past. There will then be established even better means for meeting unjust political criticism and attack, and there will be less occasion for public concern over the amazing growth of the electric industry or talk of turning this business over to the blighting hand of government ownership.

Jersey Utility Authorized to Issue Stock.—Jersey Central Power & Light Company was authorized to issue 45,400 shares of common stock at $10 a share to finance the purchase of the municipal electric light plant of Chatham, Morris County, and the Cape May Gas Company.

Electric Investors Deal Completed.—All of the assets of Electric Investors, Inc., have been taken over by the Electric Bond & Share Company, pursuant to the merger plan ratified by the stockholders of both companies last month. Stockholders have been notified that Electric Bond & Share stock is ready for distribution.

Business News and Market Conditions

THE MARKET CRASH has had little if any detrimental effect upon electrical equipment business, according to widespread inquiries made by the ELECTRICAL WORLD this week. Whether a reduced purchasing power may later reduce commitments is yet too early to say. In the opinion of one large manufacturer "the market situation seems to have affected only the individual in his buying power of luxuries and, as far as we can see, utilities have not been seriously affected as incoming business is holding up." In some sections, such as the Southeast, inquiries have fallen off and a spirit of caution prevails.

——BUSINESS SEEMS TO HAVE REVIVED on the Pacific Coast after the first slightly paralyzing effect of the market break.

——ELECTRIC RAILWAY BUSINESS IS STILL SUBSTANTIAL throughout the East and the rail electrification program is providing a large volume of business.

PACIFIC COAST

POWER COMPANY purchasing of standard equipment in carload lots has featured the past week, other branches of the industry being rather quiet.

MAIL ORDER and chain stores provide many electrical contracting jobs; a typical case is that of 500 retail stores now being built for a tire company, all needing much window and exterior lighting material.

SOUTHERN PACIFIC'S Cascade limiteds, equipped with telephones go into service November 14.

Power company orders include six carloads of crossarms, four carloads of hardware, four carloads of poles, one carload of insulators, one carload of ground rods, one carload of 3½-in. fiber conduit, one ton of tape, one carload of 1,000,000 and 1,500,000 leaded, 600-volt cable, all about equally divided between north and south. Street-lighting business includes eighteen standards for San Jose, a $10,000 extension to Alameda system, 54 standards for Sacramento, 47 standards for Pacific Grove and a nineteen-light $6,500 installation for San Leandro. Prospective industrial business covers a $700,000 produce terminal at Portland, a $1,250,000 cold storage plant for Los Angeles, a complete power installation for an Alturas lumber plant. Machinery orders are poor for the week, the only outstanding items covering a $15,000 Westinghouse elevator installation for a Los Angeles steel firm and a $75,000 General Electric switchboard for a San Francisco power company. Distributing transformer sales are excellent in the small sizes and power line construction activity looks good at the present rate for eighteen months.

Washington Pulp & Paper Company, a Zellerbach subsidiary, awarded a contract last week for furnishing a 4,000-kw. turbine for a pulp and paper mill at Port Angeles, Wash., and opened bids for $250,000 worth of motors, about 150 machines, ranging from 350 hp. down. The award for the motors is expected to be made within a few days. Motor sales to mills and industrial sources are very light, orders reported including 25 machines from 50 hp. down to dealers; ten from 75 hp. down to mills and about 30 from 100 hp. down to scattered sources. The City of Tacoma bought approximately $4,000 worth of No. 10 B. & S. single-conductor wire and the city of Seattle about $11,000 worth of triple-braid, soft-drawn weatherproof copper wire. A contract for clearing right-of-way for a 12-mile high-tension power line, the first award in a $6,000,000 power development program for the Powell River Company, Ltd., Vancouver, B. C., is awarded. An item of $3,000,000 for water-power investigations and one of $3,500,000 for construction of the third unit of the Shuffleton steam plant at Renton, near Seattle, is added to the 1930 budget of the Puget Sound Power & Light Company. Longview and Chehalis, Wash., on November 18 will open bids for ornamental lighting systems, costing approximately $25,000, and Spokane is considering an installation costing about $80,000. Washington Box & Veneer Company, Seattle, is planning a factory on a 23-acre site and the Royal City Sawmill Company, New Westminster, B. C., is planning a saw and planing mill costing about $250,000.

CONSTRUCTION PROJECTS

Technicolor Motion Picture Corporation, Los Angeles, Calif., plans film laboratory to cost about $140,000. B. F. Goodrich Rubber Company, Akron, Ohio, plans additions and improvements in plant at Los Angeles, Calif., to cost $250,000. Sacramento, Long Beach, San Jose and Pacific Grove, Calif., plan ornamental lighting system. Aeronautical Corporation, San Diego, Calif., plans aircraft manufacturing plant to cost $150,000. Seattle, Wash., plans municipal cold storage and refrigerating plant to cost about $400,000. Washington Water Power Company, Spokane, Wash., plans construction of transmission line from Spokane to Kellogg, Idaho, to operate at 110,000 volts. The Great Northern Railway Company, Great Falls, Mont., will make additions in shops at Great Falls, Mont., to cost about $90,000. Great Falls, Mont., plans ornamental lighting system. Coeur d'Alene, Idaho, plans ornamental lighting system. Ogden and Bingham, Utah, plan installation of floodlighting systems at municipal airports. Christy Manufacturing Company, Pueblo, Colo., plans juvenile furniture manufacturing plant to cost $100,000. Firestone Tire & Rubber Company, Akron, Ohio, plans factory branch and distributing plant at Phoenix, Ariz., to cost $175,000. Inter-State Concrete Products Company, Phoenix, Ariz., Harry L. Foster, manager, plans plant to cost about $160,000. Arizona Edison Company, Phoenix, Ariz., plans ice-manufacturing plant at Coolidge, Ariz., to cost about $100,000.

EASTERN

CONTINUANCE of adverse conditions in the stock market and decline in the immediate value of securities have shown no noticeable effect on the demand for electrical equipment in the Eastern district.

ORDERS are maturing at an unanticipated rate, with both central stations and industrials prominent in the buying and the outlook, based on inquiries, is satisfactory, with heavy machinery developing substantial interest.

ELECTRIC railway business is still scoring orders.

The Lackawanna Railroad Company is extending its purchases for its electrification program now in progress. An order has been placed with the Ingersoll-Rand Company and General Electric Company for two Diesel type electric locomotives, totaling about $300,000; batteries will be furnished by the Electric Storage Battery Company. In this same line, a manufacturer of car heating equipment has contracted with a New York maker for electric heating units to an amount of $65,000.

A manufacturer of prime movers and other heavy electric equipment says that the higher rate of buying which started in October is continuing into November, with no immediate curtailment in sight. Small orders are showing excellent bulk volume. A contract for three generators for a Virginia power project has been awarded to a Pennsylvania producer, while an order for turbine units has been placed with another manufacturer in the same state. A metropolitan central station has purchased a quantity of transformers, switchgear and auxiliary equipment to an amount of $180,000, from a New York maker. A Diesel engine manufacturer in Missouri will furnish a unit for a municipal station installation in Louisiana. A manufacturer of wire and

cable reports a large amount of business on hand from central stations and other consumers, and believes that the present high rate of commitments will continue well into the New Year. A maker of transformers says that the bulk of current demand is from power companies and that industrial purchases in this line show a tendency to ease.

Food product factories and chemical plants are providing a good source of outlet. A maker of washing machines in Northern New York has closed for a quantity of fractional horsepower motors to an amount of $80,000. A manufacturer of electric tools says that orders are advancing at a high rate and that the outlook is excellent. Electrical supplies are moving fair according to a New Jersey jobber, with wiring devices and equipment showing up well for early future sales. Lighting standards are recording sizable business; a plant devoted to this line in Ohio is running on a capacity schedule. About 85 new airports are projected in New York State and close to 35 in New Jersey.

CONSTRUCTION PROJECTS

Shell Eastern Petroleum Products Company, New York, is projecting plans for a storage and distributing plant at Philadelphia, Pa., reported to cost $250,000. United States Rubber Company, New York, will build an addition to its mill at Providence, R. I., to cost more than $70,000. Penn Yan Boat Company, Penn Yan, N. Y., plans plant addition to cost $150,000. Sterling Engine Company, Buffalo, N. Y., has filed plans for an addition to gasoline engine plant to cost $75,000. Atlas Portland Cement Company, New York, is projecting plans for a cement mill near Havana, Cuba, to cost in excess of $1,000,000. New York will build a repair and distributing plant for the street-cleaning department at Long Island City, estimated to cost $180,000. Horace E. Dodge Boat & Plane Company, New York, has approved plans for a motor boat and seaplane manufacturing plant at Newport News, Va., to cover over $1,000,000. Campbell Carpet Cleaning Company, New York, will carry out an expansion and improvement program at plant to cost about $65,000. Public Service Electric & Gas Company, Newark, N. J., has filed plans for an equipment storage and distributing plant, and garage at Trenton, N. J., to cost $100,000. Driver-Harris Company, Harrison, N. J., will build several additions to wire-manufacturing plant, including power house, reported to cost about $400,000. Commissioner of Institutions and Agencies, Trenton, N. J., will receive bids until November 21, for underground conduits and electric lines at the Newark airport. Lebanon Steel Foundry Company, Lebanon, Pa., has approved plans for an addition to cost $200,000. Bethlehem Steel Company, South Bethlehem, Pa., will make extensions and improvements in Cambria mill at Johnstown, Pa., to cost about $10,000,000, in addition to expansion program at Baltimore to cost $25,000,000, previously announced. Baugh Chemical Company, Baltimore, Md., plans fertilizer plant to cost about $100,000. Victor Cooler Door Company, Hagerstown, Md., plans addition to refrigerator door factory to cost $110,000. Bureau of Yards and Docks, Navy Department, Washington, D. C., will receive bids until November 20 for engine-generators and instruments at Iona Island, N. Y. (Specification 6024). Veterans' Bureau, Washington, D. C., will receive bids until December 31 for ice-making and refrigerating plant, electric distributing system, electric elevators, etc., at the United States Veterans' Hospital, Lincoln, Neb.

SOUTHWEST

GENERAL business in all electrical lines seems to be holding up to the level previously reported.

ORDERS for distribution transformers and meters have been in good volume for the past week.

One of the large railway systems is trying out seven gas electric cars recently purchased on a division out of St. Louis and will later put them in service on other parts of the system. Some of these cars have 800-hp. and others 400-hp. motors. The average cost of the electrical equipment is around $15,000. Orders were placed for a lot of motors for driving pumps to cost about $5,000. White-way equipment to cost $8,000 was bought by a town in Missouri.

CONSTRUCTION PROJECTS

Wewoka, Okla., plans installation of floodlighting system at municipal airport. Public Service Company of Oklahoma, Tulsa, is perfecting plans for an addition to power plant at Weleetka, reported to cost about $750,000. Grayburg Oil Company, San Antonio, Tex., plans oil refining plant to cost $2,000,000. Austin, Tex., plans installation of floodlighting system and beacon lamps at municipal airport in connection with expansion to cost $85,000. Merchants' Ice & Storage Company, San Antonio, Tex., is planning an addition to cold storage and refrigerating plant reported to cost about $80,000. Southwestern Gas & Electric Company, Shreveport, La., plans extension in transmission line from Hosston to Vivian, La., and vicinity, reported to cost $35,000.

SOUTHEAST

FALLING off is to be noted in large orders, though the volume of small-sized orders continues fairly satisfactory.

THERE is a decrease in the number of inquiries received, especially from industrials, and it would seem that a cautious policy in purchasing will be the case until it is ascertained with more certainty the course of future events.

A Georgia company ordered last week low-tension switching equipment approximating $85,000 for steam plant installation and the same company also ordered voltage regulators amounting to $38,500. One company's solid weatherproof and bare stranded copper wire orders last week aggregated $14,100 and its distribution and small power transformer orders totaled $11,100. Another central station order was for creosoted pine poles, amounting to $3,300. An order for small power transformers costing between $7,000 and $8,000 is in more or less immediate prospect in the Carolinas. A paper mill in Louisiana ordered steam condenser equipment costing $30,000 and mining interests in the Birmingham section ordered industrial equipment amounting to $6,000.

CONSTRUCTION PROJECTS

Dominion Oil Company, Richmond, Va., will build an oil storage and distributing plant to cost $125,000. Virginia Electric & Power Company, Richmond, Va., is planning an equipment storage and distributing plant to cost about $150,000. Southern Silk Garment Company, Martinsville, Va., plans plant to cost $100,000. Benedict Coal Company, Knoxville, Tenn., plans rebuilding of tipple and other structures at properties at St. Charles, Va., recently destroyed by fire with loss of about $150,000. Globe Brick Company, Kenilworth, W. Va., has authorized an addition to cost $100,000. Dunbar Flint Glass Company, Dunbar, W. Va., will make extensions and improvements to cost about $150,000. Summers-Hermann Company, Louisville, Ky., plans automobile service and repair building to cost $120,000. Jackson, Tenn., is said to be planning early call for bids for municipal power plant to cost about $700,000. Agricola Brick Company, Gadsden, Ala., plans power substation for service at plant, power to be furnished by the Alabama Power Company. Valdosta, Ga., plans installation of floodlighting system and beacon lamps at proposed municipal airport. Gulf Power Company, Pensacola, Fla., plans extensions in transmission line in Baldwin County.

MIDDLE WEST

BUSINESS in the Middle West section continues on a satisfactory basis, the volume of business remains substantially large and no apprehension is evidenced toward future business; major activities are adjusting themselves to present conditions and a feeling of confidence is apparent.

VARIOUS RAILROADS are purchasing equipment in large quantities and car loadings are relatively high.

THE ELECTRICAL INDUSTRY continues conservatively with plans formulated for this period; considerable purchasing of apparatus is going on, while there is an excellent demand for distribution equipment.

Some of the interesting orders placed this week include one for a 105,000-kw. turbo-generator set complete with appurtenances to cost $1,250,000, heating and evaporating equipment to cost $50,000, 100 10-kva., 100 15-kva., 50 25-kva., 50 37½-kva., 50 50-kva., 25 75-kva., 25 100-kva., 25 150-kva., 25 200-kva. single-phase, 60-cycle pole type distribution transformers, ten 25-kva., ten 50-kva. ten 75-kva., twenty 100-kva., twenty 150-kva., twenty 200-kva., fifteen 300-kva. single-phase subway type transformers, ten 50-kva., ten 75-kva., fifteen 112½-kva., ten 150-kva., fifteen 225-kva., five 300-kva., five 450-kva. three-phase subway type transformers and 96 600-amp., 15-kva., single-pole, single-throw, frame-mounted solenoid-operated oil circuit breakers. Job-

bers' sales are normal. There has been a sustained demand for most appliances, particularly washing machines, one jobber placing a single order for 1,000 machines.

CONSTRUCTION PROJECTS

Oshkosh Foundry Company, Oshkosh, Wis., plans addition to cost $65,000. Liethen Grain Company, Appleton, Wis., plans an addition to cost $65,000. Detroit Die-Casting Company, Detroit, Mich., has plans for an addition to cost $80,000. Wayne County Board of Commissioners, Detroit, Mich., will take new bids for a power plant to cost $70,000. American Forging & Socket Company, Pontiac, Mich., contemplates plant unit reported to cost more than $75,000. Gibb Welding Machines Company, Bay City, Mich., contemplates an addition reported to cost more than $75,000. Evanston, Ill., has authorized revised plans for street-lighting system to cost more $1,500,000. Rock Island, Ill., plans installation of floodlighting system and beacon lamps at municipal airport, entire project to cost $360,000. Bendix Brake Corporation, South Bend, Ind., has filed plans for additions to cost $450,000. Ohio Bell Telephone Company, Toledo, Ohio, will build an equipment storage and distributing plant to cost about $200,000. Newark, Ohio, plans installation of floodlighting system and beacon lamps at proposed municipal airport. Dayton Power & Light Company, Dayton, Ohio, has plans for a power substation at Troybine, Ohio. Atlas Steel & Supply Company, Cleveland, Ohio, plans addition to cost about $70,000. Watertown, S. D., is contemplating a municipal electric light and power plant reported to cost about $140,000. Board of Park Commissioners, Minneapolis, Minn., plans an ornamental lighting system around Lake Nokomis. Chicago, St. Paul, Minneapolis & Omaha Railway Company, St. Paul, Minn., plans engine house and shops at Mankato, Minn., to cost $60,000. New Prague Co-Operative Creamery Company, New Prague, Minn., plans plant to cost $60,000. Northwest Airways, Inc., St. Paul, Minn., plans hangar and mechanical buildings at airport to cost $100,000. Burlington Brass Company, Burlington, Iowa, plans addition to cost about $60,000.

New England

NEGOTIATIONS for heavy electrical industrial equipment are active and buying is steady; small motors are outstanding in interest.

MERCHANDISING, in view of unsettled financial conditions at large, is remarkably encouraging.

Sales of small motors feature the buying of electrical equipment, with one week's total amounting to over $40,000. A number of orders for groups running up to twenty motors was noted; large ratings were few. Scheduled switch and control apparatus sales remain steady. Recently stocking up among central stations was renewed. Industrial plants are active in additions and are buying. Increases in plant loads amounting up to 100 hp. were noted recently.

Negotiations for turbo-generators are active; orders for smaller units, amounting to about 2,000 kw., have been received by one manufacturer. Industrial electric furnaces are attracting more interest than usual, according to one representative; small heat-treating types for machine tool industries are in demand; melting pots command steady attention. Floodlighting and street illumination are active. Floodlighting projects now receiving attention include projects for automobile parking areas in an eastern Massachusetts city, increase of lighting for a large playground and increased activity in spotlight use for display purpose. New street lights are being considered in a Massachusetts city.

Contrary to prevailing views, electrical equipment buying shows little decline. Merchandising is particularly strong, according to well-informed sources; gains reported during the past two weeks by one group of central stations amount to over 30 per cent to date for the year. This same group shows that electrical domestic appliances have lost none of their appeal; sales reports reveal gains of over 50 per cent for this period.

CONSTRUCTION PROJECTS

Boston Ice Company, Boston, Mass., plans ice-manufacturing plant to cost more than $80,000. Swift & Company, Chicago, Ill., meat packers, will build a factory branch and distributing plant at Boston, Mass., to cost $80,000. Lamb & O'Connell Shipyard, Squantum, near Quincy, Mass., plans rebuilding of portion of plant recently destroyed by fire with loss of close to $70,000. Hemphill Company, Pawtucket, R. I., will build an addition to knitting machinery manufacturing plant to cost about $50,000. Fairfield County Ice Company, Stamford, Conn., has filed plans for an ice-manufacturing plant to cost about $50,000.

Activities of the Trade

Welding Companies Merge

Formation of the Thomson-Gibb Electric Welding Company, a consolidation of the Thomson Electric Welding Company of Lynn, Mass., and the Gibb Welding Machines Company of Bay City., Mich., has been announced. Both plants will continue in operation. A full line of butt, flash, seam, spot, projection and wire fabric welders will be offered by the new company. The company expects immediately to place competent engineers direct from the factory at Boston, New York, Philadelphia, Cleveland, Cincinnati, Detroit, Chicago and St. Louis.

Westinghouse Net Shows Heavy Gain

The Westinghouse Electric & Manufacturing Company reports for nine months ended September 30, 1929, net profit of $19,544,211 after depreciation, interest and federal taxes, equivalent to $7.32 a share (par 50) on 2,666,315 shares of combined preferred and common stock. This compares with $14,290,035, or $6.03 a share, on 2,370,063 combined shares in the first nine months of 1928.

	1929	1928
Orders received	$185,625,135	$143,637,037
Sales billed	159,545,778	138,572,390
*Profit	19,796,819	15,425,424
Interest charges	252,607	1,135,389
Net profit	$19,544,211	$14,290,035

Quarter ended September 30:

	1929	1928
Orders received	$64,440,589	$48,044,850
Sales billed	59,617,988	48,529,399
*Profit	6,413,955	6,749,853
Interest charges	1,125	376,733
Net profit	$6,412,830	$6,373,120

*After depreciation and federal taxes.

Net profit for the quarter ended September 30 amounted to $6,412,830 after above charges, equal to $2.40 a share on 2,666,315 combined shares, comparing with $7,499,681, or $2.81 a share, on 2,666,315 combined shares in the preceding quarter and $6,373,120, or $2.68 a share, on 2,370,063 combined shares in the third quarter of previous year.

American Bosch Magneto Establishes Credit Union

On the ground that financial difficulty and the worries attending it is a main cause of employee inefficiency, the American Bosch Magneto Corporation of Springfield, Mass., has established an organization providing a source of credit to employees. This Credit Union, as it is called, is designed to be of definite aid to employees in forestalling embarrassment by the attachment of wages for obligations incurred and to help in times of financial stress, family illness or any other burden.

Discussing the formation of the organization, F. Watts, president of the American Bosch Credit Union, said:

After considering many plans, such as a fund set up by the company and lent to deserving employees at a low rate of interest, and co-operative buying for the employees, financed by the company, we hit upon the Credit Union as organized under the state credit union laws and championed by E. A. Filene. This was suggested to a group of the employees and we did the rest.

We organized, adopted a constitution and by-laws, elected officers and, on August 1, 1929, commenced business under a charter issued by the Commissioner of Banks of Massachusetts.

We sell shares of $5 each in weekly installments of 25 cents. A member can take out any number of shares he wants.

We do not guarantee interest, but twice yearly we will declare a dividend which we expect will equal a return of 6 per cent or better on the money invested.

We loan money to members upon the approval of the credit committee. Up to $50 can be lent, secured only by the note of the member, and up to $200 with the addition of the signatures of two other members as co-signers. Interest is deducted at the rate of 6 per cent per year. No other charges are made except fines for non-payment of 1 per cent per week overdue.

This has resulted in the deposit by 270 members of over $4,000 in three months. All but $400 of this has been loaned to 65 borrowers, no defaults have been recorded and all this unsolicited. We did not want to grow faster than our officers could acquaint themselves thoroughly with the work and we could get the necessary experience and the approval of the banking commissioner upon his first visit.

Many of our loans have been made to employees for the purpose of wiping out the high interest-bearing notes of the commercial small loan companies. Some have been made to members purchasing large orders of canned goods at wholesale and at the harvest-time prices and some to pay off local merchants who were continually harassing our employees and considerably reducing the efficiency of these men at their work. All loans are made in the strictest confidence and, because our members realize this, I believe with the experience that the officers are speedily gaining we can be of much help to our members in getting them out of their financial tangles and prevent to some degree their reoccurrence.

Southern Pacific Working on New Control Equipment

Union Switch & Signal Company recently received a $300,000 order for electrical equipment from the Southern Pacific Company. The latter company, which also placed a $50,000 order for wire and pole line supplies, is working on an electrical remote-control system for operating its trains along the remarkably busy single-track line between Sacramento and Stockton. This 40-mile stretch is a link between the great grape and fruit growing districts of the San Joaquin Valley and the overland freight traffic, and it is planned to control the movements of the big fruit trains without train orders or crew switching at the passing tracks.

The project has been under the charge of W. E. Boland, signal engineer of the Southern Pacific Company, and the field work has been supervised by P. A. Bliss. The net result is expected to be a 50 per cent cut in the time of operation along this important section.

Westinghouse Announces Annuity Plan

EMPLOYEES of the Westinghouse Electric & Manufacturing Company who retire at the age of 65 years or older will be guaranteed substantial incomes for the remainder of their lives as the result of the institution of a new and scientific annuity payment plan announced by Frank A. Merrick, president of the Westinghouse company. Affecting all of the 50,000 workers on the Westinghouse payroll, the plan is one of the largest in scope and one of the first of its type to be established anywhere. The plan's coverage, reckoned after the manner of group insurance coverages, will be approximately $54,000,000 at the beginning and $14,500,000 annually thereafter.

Under the Westinghouse plan an employee not only receives from the company an earned reward for length of service but also has an opportunity to buy additional retirement income for himself at a favorable rate. One of the distinctive features of the Westinghouse annuity plan is that it offers no obstacle to the employment of the older workers, as every employee reaching his retirement age receives his proportionate retirement income.

"The company's part of the plan's cost," said Mr. Merrick, "will be paid as a regular operating expense, just as wages and repair costs are paid. The plan sets up a contractual agreement which binds the company to do its part irrespective of what employees may do. Employees will be encouraged, but by no means obliged, to participate in the plan."

At the expiration of every year of service the employee will receive an annuity certificate entitling him to a number of units of income after retirement. Every retirement income unit will yield one dollar a month beginning at retirement age and lasting for life. The number of units the employee receives annually will depend on his salary or wage. If he wishes, the employee can make his annuity income payable to himself and wife as long as either may live. A notable result achieved by this method of drafting the plan is that the hitherto unsolved problem of accrued liability has been eliminated and the uncertain and increasing future cost has been replaced by a known level maximum cost for the entire future. The net annual cost of the plan to the company is estimated to be 1.2 per cent of the payroll and by the use of a new budget method the net cost is automatically exhibited every month.

WAGNER ELECTRIC CORPORATION, St. Louis, Mo., has named D. O. Reardon as its representative in Iowa with headquarters in Des Moines. For the past seven years Mr. Reardon was Iowa representative for the merchandising division of the Westinghouse Electric & Manufacturing Company.

HALL ELECTRIC HEATING COMPANY has announced the appointment of A. O. Miller to the position of general sales manager with headquarters in Philadelphia. Mr. Miller was formerly with the American Brown Boveri Company, Inc.

Maytag Reports Substantial Increase in Net

Maytag Company reports for nine months ended September 30, 1929, net profit of $4,892,484 after charges and federal taxes, equivalent after dividend requirements on $6 first preferred and $3 preference stocks to $2.35 a share on 1,617,807 no-par shares of common stock. This compares with $4,095,453, or $1.83 a share, on 1,600,210 common shares during the first nine months of 1928. Net profit for quarter ended September 30 totaled $1,656,362 after above charges, equal to 80 cents a share on 1,617,807 common shares, against $1,915,154, or 97 cents a share, on 1,608,795 common shares in the preceding quarter and $1,546,366, or 72 cents a share, on 1,600,210 common shares in the September quarter of the previous year. Net sales for the nine months totaled $19,687,836, comparing with $17,628,206 for the first nine months of 1928, and for the quarter ended September 30 were $6,581,553, against $6,499,914 in the third quarter of 1928.

SIMONDS CHAIN MANUFACTURING COMPANY reports L. A. Benson & Company of Baltimore have been appointed distributors for Simonds roller chains to the industrial trade.

CROCKER-WHEELER ELECTRIC MANUFACTURING COMPANY has called for redemption all of its outstanding 7 per cent preferred stock, totaling 8,632 shares, at $108 a share and accrued interest from October 1 to November 4, inclusive. This will leave as the only outstanding issue 232,400 shares of common stock.

CHAMPION SWITCH COMPANY, Kenova, W. Va., announces that J. A. Dudley, formerly of the Chrysler Corporation, is in charge of production at Kenova.

KELVINATOR CORPORATION announces the appointment of Vance C. Woodcox to the position of domestic sales manager. Mr. Woodcox has been with the Kelvinator Corporation for four years.

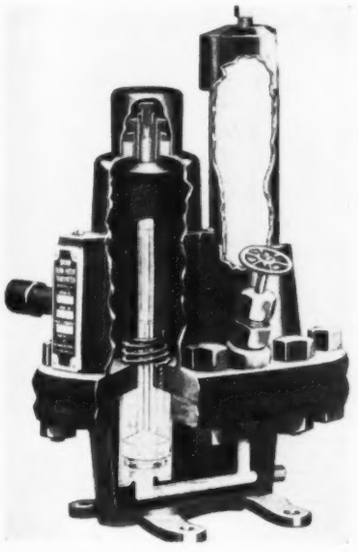
ELECTRAD, INC., manufacturer of resistance and other specialties, with headquarters in New York, has closed a lease for additional manufacturing space at the present location, 173-175 Varick Street.

CURTIS LIGHTING, INC., announces the appointment of Walter H. White as resident engineer for the Kansas City, Mo., district. Mr. White takes over his new duties following the recent appointment of Harvey B. Wheeler, formerly Curtis resident engineer in Kansas City, as sales manager for the New York office of the same company. The appointment of Paul A. Douden as resident engineer in the Denver district has also been announced. Mr. Douden's territory includes the states of Colorado, Wyoming and part of Idaho with headquarters in Denver, Colo.

New Equipment Available

Flow Meter Manometer for High Pressures

A manometer, model No. 254, has been designed for use under high pressure not exceeding 1,500 lb. per square inch by the Brown Instrument Company of Philadelphia. Like the standard manometer, No. 253, all stuffing boxes



and electrical connectors are eliminated in the pressure chamber. This instrument is essentially a mercury-filled "U" tube, made of a two-part steel forging. A connection between the two parts is made by a tongue-and-groove joint, which permits the use of a narrow gasket, that will withstand very high gasket pressure.

The manometers are subjected before delivery to a 2,500-lb. pressure test for a period of six hours. The high pressure and low pressure connections are made of extra-heavy seamless steel tubing. The equalizing valve which is located in the instrument has a monel metal stem and packing gland. This valve is of the needle type and eliminates any possibility of leaking between the high and low pressure sides of the manometer.

Wide-Range Resistance "Megger"

For measuring resistance from 0.01 ohm up to 100 megohms (100,000,000 ohms), James G. Biddle, 1211 Arch Street, Philadelphia, Pa., is offering a new instrument called the "Bridge-Meg" resistance tester. It combines in one unit facilities for making Wheatstone bridge measurements of conductor resistance at 250 volts, and also megger tests of insulation resistance at 500 volts. It weighs but 12¾ lb. and measures 7x8¾x12 in.

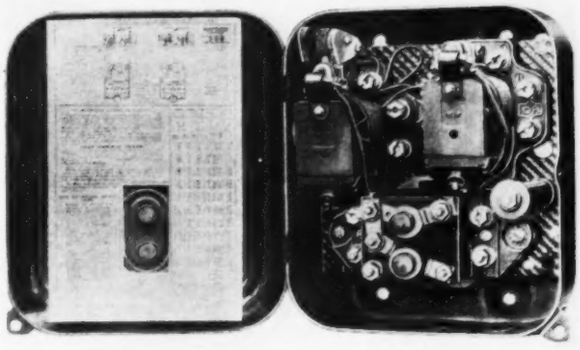
The range of measurements covered by the "bridge" is from 0.01 ohm up to 999,000 ohms and the "meg" range is from 10,000 ohms up to 100 megohms. As a "bridge" it is operated in the same way as an ordinary Wheatstone bridge, except that instead of employing a battery, current at 250 volts is supplied by the hand generator, and the ohmmeter is used as a galvanometer for balancing.

An important feature of the hand generator is a slip-clutch arrangement, by which a constant potential is delivered when the hand crank is turned at or about its greatest speed of 160 r.p.m.

Double Line Break Starter

A new automatic across-the-line starter for general applications of direct-current motors up to 2 hp., 115 or 230 volts, is announced by Cutler-Hammer, Inc., Milwaukee, Wis. New features claimed are its small size, low cost, double-line break, thermal overload protection, low voltage protection, silver contacts and completely inclosed structure. Two magnetic contactors, one on each side of the line, connect the motor directly across the line, on starting, and provide a double line break. The contactors are designed especially for direct-current service. They have renewable silver contacts and heavy stamped frame.

The thermal overload relays are the same as those used in the company's alternating-current across-the-line starters for small motors. They are the fusible alloy type and can be adapted to any size motor by simply changing the heater coils. When tripped by an



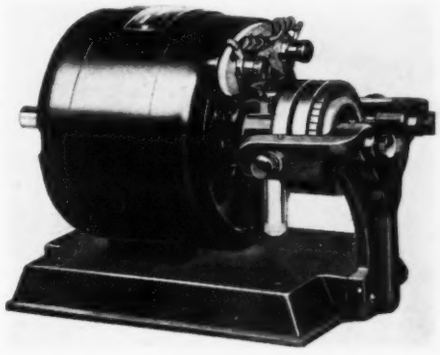
overload the relays are reset by pushing a button in the cover.

Each starter is furnished with a push-button master switch, providing three-wire control. This master switch can be mounted in the cover or separately.

Motor-Driven Pole Changer

A new motor-driven contact maker for converting direct current to alternating current by reversing the direct current through a special commutator is announced by the Bodine Electric Company of Chicago. The direct current is fed to the commutator through a pair of slip rings and the output is taken from brushes in contact with the commutator.

The motor can be wound for any alternating or direct current voltage and has no electrical connection with the slip rings or commutator. For



therapeutic work the commutator is designed to give an alternating current of 360 cycles per second or higher if necessary. The same equipment can be used for selected frequency ringing or for any purpose requiring an alternating current. These units are made in capacities of 100 watts or higher.

A SELF-SEALED, SELF-LUBRICATED BALL BEARING which, it is claimed, reduces mounting costs and increases bearing efficiency in service life is announced by the New Departure Manufacturing Company, Bristol, Conn. It is called the "N. D. seal bearing," is made only in the smaller sizes and consists of what is essentially a New Departure single row ball bearing of the non-loading groove type permanently fitted into a metal case or a shell. The shell is shaped on one side of the bearing so as to contain a felt closure which fits over the ground outside diameter of the extended bearing inner ring.

AN ALL-PURPOSE TOOL GRINDER adaptable either to wood shop or general shop and driven by a 1-hp., 1,750-r.p.m. fully inclosed dustproof motor built by the Westinghouse Electric & Manufacturing Company is announced by the J. G. Blount Company of Everett, Mass. The machine is of the motor-in-head type. The spindle is extra heavy and runs in heavy-duty deep-grooved ball bearings.

Electrical Patents

Announced by U. S. Patent Office

(Issued October 15, 1929)

1,732,136. ELECTRIC WELDING MACHINE; F. P. McBerty, Warren, O. App. filed Nov. 2, 1927.

1,732,146. SECONDARY CLOCK; J. A. Webb, Corpus Christi, Tex. App. filed Nov. 2, 1925.

1,732,152. TEMPERATURE - INDICATING MEANS; W. A. Collins, Brooklyn, N. Y. App. filed May 13, 1926.

1,732,157. SWITCH; J. E. Fisher, Hamilton, O. App. filed Nov. 17, 1926.

1,732,158. STORAGE-BATTERY-CELL CLOSURE; B. Ford, Philadelphia, Pa. App. filed Dec. 6, 1924.

1,732,165. DIRECTION SIGNAL FOR AUTOMOBILES; W. H. Kelly, Reno, Neb. App. filed Feb. 16, 1928.

1,732,179. PROCESS OF MANUFACTURING NICKEL FLAKES FOR USE AS ADMIXTURE IN THE ACTIVE MATERIAL OF ALKALINE ACCUMULATORS; E. Breuning, Hagen, and O. Schneider, Frankfort-on-the-Main, Germany. App. filed July 9, 1927.

1,732,181. SWITCH INTERLOCK DEVICE; J. F. Burns, Philadelphia, Pa. App. filed Feb. 27, 1920.

1,732,182. CIRCUIT MAKER AND BREAKER; F. S. Denison, Minneapolis, Minn. App. filed June 27, 1925.

1,732,204. ACTUATING UNIT FOR SPEAKERS; N. M. Michailovsky, Bronx, N. Y. App. filed Aug. 23, 1928.

1,732,205. DRIVING UNIT FOR LOUD-SPEAKERS; N. M. Michailovsky, Bronx, N. Y. App. filed Aug. 23, 1928.

1,732,208. ADJUSTABLE BODY WITH CLUSTER; C. E. Wirth, Waterbury, Conn. App. filed Feb. 18, 1925.

(Issued October 22, 1929)

1,732,261. BATTERY TERMINAL; C. Crews; Charleston, W. Va. App. filed Sept. 19, 1928.

1,732,265. FUSE BLOCK FOR THERMAL CUT-OUTS; J. M. Fried, Vicksburg, Miss. App. filed Nov. 1, 1928.

1,732,275. RESISTANCE ELEMENT; H. Martin, Southsea, England. App. filed March 8, 1921.

1,732,276. ALARM APPARATUS; J. A. Morrison, Spokane, Wash. App. filed April 29, 1926.

1,732,280. INCUBATOR; J. L. Robbins, Edgewater, Colo. App. filed July 11, 1927.

1,732,292. AUTOMATIC RECLOSING CIRCUIT-BREAKER SYSTEM; O. C. Traver, Schenectady, N. Y. App. filed May 22, 1926.

1,732,295. CIRCUIT INTERRUPTER; E. Aichele, Irvington, N. J. App. filed Feb. 26, 1926.

1,732,296. AUTOMATIC RECLOSING CIRCUIT-BREAKER SYSTEM; A. E. Anderson, Scotia, N. Y. App. filed June 27, 1927.

1,732,317. METHOD OF SOLDERING OF CHAIN AND RING-MESH FABRICS; E. Thoma, Pforzheim, Germany. App. filed Sept. 4, 1924.

1,732,333. INDUCTION ELECTRICITY METER; J. Harris, La Fayette, Ind. App. filed April 23, 1928.

1,732,336. METHOD AND APPARATUS FOR PURIFYING AND CHARGING A GAS INTO VACUUM TUBES OR OTHER CONTAINERS; R. W. Lohman, Los Angeles, Calif. App. filed Nov. 1, 1926.

1,732,339. APPARATUS FOR FINISHING INSULATOR SHELLS; D. H. Osborne, Jeffersonville, Pa. App. filed Jan. 11, 1927.

1,732,344. CIRCUIT CONTROLLING SWITCHING MECHANISM; O. N. Tevander, Chicago, Ill. App. filed May 14, 1928.

1,732,346. BATTERY-CHARGING APPARATUS; A. E. Waller, Bronxville, N. Y. App. filed June 16, 1925.

1,732,367. MOTOR CONSTRUCTION AND REGULATING MEANS THEREFOR; E. E. Kleinschmidt, Chicago, Ill. App. filed March 31, 1923.

1,732,383. METHOD OF AND APPARATUS FOR ELECTRIC WELDING; F. L. Sessions, Lakewood, O. App. filed Oct. 15, 1925.

1,732,396. TELEMETRIC GAS ANALYZER; M. Bock, Hamburg, Germany. App. filed Nov. 19, 1926.

1,732,431. ELECTRODE SEAL FOR ELECTRIC FURNACES; J. Bruggmann, Neuenhof, near Baden, Switzerland. App. filed Dec. 6, 1926.

1,732,441. ELECTRODE HOLDER; H. Griffiths, Buffalo, N. Y. App. filed Dec. 8, 1926.

1,732,464. CONTROL SYSTEM; W. Fourness, Pasadena, Calif. App. filed July 28, 1926.

1,732,477. PROTECTIVE DEVICE; C. W. Kuhn, North Milwaukee, Wis. App. filed March 8, 1926.

1,732,488. LIGHT-FLASHING SYSTEM; M. H. Schoenberg and L. Schon, San Francisco, Calif. App. filed Sept. 29, 1926.

1,732,502. ICE-CREAM DISHER; J. W. Cox, Erie, Pa. App. filed Nov. 12, 1926.

1,732,523. MACHINE FOR ATTACHING LATCHES TO LATCH KNITTING NEEDLES; G. W. Mayo, Laconia, N. H. App. filed Jan. 20, 1928.

1,732,547. FREQUENCY CHANGING SWITCH; A. M. Trogner, East Orange, N. J. App. filed Oct. 8, 1926.

1,732,577. MEANS FOR OPERATING ELECTRIC SWITCHES AND OTHER MECHANISM; A. C. Durdin, Jr., Chicago, Ill. App. filed Dec. 29, 1926.

1,732,598. DYNAMO-ELECTRIC MACHINE; V. A. Fynn, St. Louis, Mo. App. filed Jan. 10, 1927.

1,732,607. DISTURBANCE ELIMINATOR; V. Kulebakin, Moscow, Russia. App. filed March 29, 1923.

1,732,609. ELECTRICAL DISTRIBUTION SYSTEM; L. Lyndon, New York, N. Y. App. filed Oct. 17, 1923.

1,732,622. CONTACT FOR LAMP HANGERS; A. J. Thompson, Cleveland, O. App. filed Oct. 8, 1925.

1,732,623. ELECTRIC-FURNACE LINING; M. Tilley, Cleveland, O. App. filed Aug. 18, 1927.

1,732,667. ELECTRIC WATER HEATER; C. W. Thoerig, Vienna, Austria. App. filed Nov. 12, 1927.

1,732,674. HUMIDIFIER; R. J. Dever, Wilkes-Barre, Pa. App. filed Sept. 12, 1928.

1,732,687. REACTIVE VOLT-AMPERE METER; B. E. Lenehan, Wilkinsburg, Pa. App. filed April 29, 1927.

1,732,688. COMBINED SIGNAL SYSTEM; E. B. Mallory, Tenafly, N. J. App. filed Aug. 25, 1923.

1,732,707. ELECTRIC LAMP AND PERFUME HOLDER THEREFOR; W. A. Winsboro, Los Angeles, Calif. App. filed Aug. 3, 1927.

1,732,711. CONTROL SYSTEM; C. A. Boddie, Pittsburgh, Pa. App. filed May 4, 1920.

1,732,712. VARIABLE-VOLTAGE-CONTROL SYSTEM; E. M. Bouton, East Pittsburgh, Pa., and C. P. Walker, Los Angeles, Calif. App. filed Feb. 6, 1922.

1,732,713. ELECTRICAL SWITCH GEAR; T. C. Christianson, Manchester, England. App. filed Feb. 20, 1924.

1,732,715. ELECTROMAGNETIC INDUCTION APPARATUS; F. Dessauer and W. Petersen, Frankfort-on-the-Main, and E. Welter, Darmstadt, Germany. App. filed Jan. 15, 1924.

1,732,718. DEVICE FOR CONTROLLING THE FIRING OF ORDNANCES OR THE LIKE WHEN FIRING AT A MOVING TARGET; B. Glüer, Berlin, Germany. App. filed June 18, 1925.

1,732,723. ELECTRIC SWITCH; W. H. Keir, Wilkinsburg, Pa. App. filed Nov. 4, 1926.

1,732,726. METHOD OF AND APPARATUS FOR MEASURING VOLT AMPERES; B. E. Lenehan, Wilkinsburg, Pa. App. filed June 10, 1927.

1,732,731. CONTACT CONSTRUCTION; M. M. Samuels and J. Amon, New York, N. Y. App. filed Aug. 16, 1924.

1,732,734. SYNCHRONIZING SYSTEM; P. Thomas, Edgewood, Pa. App. filed Oct. 20, 1927.

1,732,736. CIRCUIT BREAKER SYSTEM; D. C. West, East Pittsburgh, Pa. App. filed April 12, 1928.

1,732,742. TRANSFORMER TAP CHANGER; W. M. Dann, C. L. Knotts, A. W. Thompson and L. H. Hill, Sharon, Pa. App. filed April 12, 1926.

1,732,744. REGULATOR SYSTEM; W. W. Edson, Newtonville, Mass. App. filed June 23, 1925.

1,732,746. AUTOMATIC SYNCHRONIZING OF FREQUENCY CHANGERS; R. D. Evans, Pittsburgh, Pa. App. filed Feb. 1, 1928.

1,732,750. PRESSED-METAL SWITCH; C. H. Hodgkins, Pittsburgh, Pa. App. filed Dec. 22, 1919.

1,732,784. CIGAR LIGHTER; S. L. Wolfson, Meriden, Conn., and C. C. Schoen, Detroit, Mich. App. filed Oct. 8, 1928.

1,732,794. DIRECTION SIGNAL; R. de Bersaques, Seattle, Wash. App. filed March 26, 1925.

1,732,797. ELECTROLYTIC CELL; F. A. Eustis, Milton, Mass. App. filed Sept. 19, 1925.

1,732,801. CIRCUIT INTERRUPTER; C. Aalborg, Pittsburgh, Pa. App. filed March 23, 1921.

1,732,823. METERING SYSTEM; C. P. West, Pittsburgh, Pa. App. filed Dec. 9, 1927.

1,732,857. HIGH TENSION CUT-OUT AND THE LIKE; A. S. Pearl, Chicago, Ill. App. filed March 21, 1927.

1,732,895. UNI OR MULTI POLAR OIL BREAK SWITCH; H. Kergel, Dresden, Germany. App. filed Aug. 7, 1924.

1,732,900. APPARATUS FOR WELDING THE TIE PLATES TO STEEL TIES; L. Kuhl and C. Ritz, Berlin-Charlottenburg, Germany. App. filed May 16, 1927.

New Trade Literature

SWITCHES.—Bulletin No. 10 has just been issued by the Hart Manufacturing Company, Hartford, Conn., covering all types of remote-control switches for lighting circuits and other remote-control service. It is illustrated with wiring and dimensional diagrams and many types of installations showing a variety of applications. Bulletin No. 12 covers flush and surface switches and switch plates for all purposes and bulletin No. 14 automatic door bolt control switch for hotel, bedrooms and theater dressing rooms, also schematic wiring diagrams of complete wiring circuit of room.

CONDENSERS. — Description of Westinghouse surface condensers as manufactured by the Westinghouse Electric & Manufacturing Company are described in leaflet 20409, a recent publication of that company. Besides describing the construction of the condensers the leaflet contains considerable application data useful for those contemplating installing condensers of this type.

OVENS.—The Despatch Oven Company of Minneapolis, Minn., maker of ovens for industrial, commercial and laboratory uses, has recently published two new bulletins, Nos. 80 and 81, featuring core and mold ovens for foundries. These ovens are of the batch type in various sizes and are designed for electric heating with or without automatic temperature control.

MOTORS. — American Electric Motor Company, Cedarburg, Wis., has issued bulletin No. 102, containing a general description of the various types of motor, advantages of each and method of manufacture.

COMMUTATOR MAINTENANCE. — An interesting piece of literature, which is really a commutator maintenance encyclopedia, has just been issued by the ideal Commutator Dresser Company, Sycamore, Ill. Contained in its pages is a brief history of commutator maintenance, a special chapter on the operation of direct-current generators, a chapter on commutator troubles and remedies and tables on fusing, wiring and full-load current data.

RECEPTACLES. — Crouse-Hinds Company, Syracuse, N. Y., has just issued catalog 2200, containing listings of conduits, groundulets and plugs and receptacles.

SWITCHBOARD METERS. — Sangamo Electric Company, Springfield., Ill., has issued addenda to bulletin No. 73, describing the Sangamo type HN alternating-current switchboard meter. This four-page leaflet contains technical data and prices.

MACHINE TOOLS.—At the machine tool convention held recently in Cleveland, the Westinghouse Electric & Manufacturing Company issued a folder entitled "Machine Tools Provided by Westinghouse." This is a completely illustrated leaflet, showing 28 different types of machine tools, each from a different manufacturer and all covered with Westinghouse motors.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

Agency is sought in London, England (No. 41,891), for cafeteria and restaurant electric equipment.

Agency is sought in Buenos Aires, Argentina (No. 41,784), for hand and hair driers and other drying equipment.

Agency is sought in Goerlitz, Germany (No. 41,786), for hotel and restaurant electric appliances.

Agency is sought in Berlin, Germany (No. 41,785) for household electrical appliances.

Agency and purchase are sought in Hamburg, Germany (No. 41,870), for household and restaurant electric appliances (washing machines, dishwashers, etc.).

Purchase is sought in Barcelona, Spain (No. 41,827), of porcelain insulators.

Agency is sought in Hamburg, Germany (No. 41,894), for electric washing machines, dishwashers, etc., for households, restaurants and hotels.

Business Facts for Electrical Men

Selected Statistics Presented Graphically for the Use of All Interested in Analyzing the Trend of the Electrical Business

What Is the Appliance Load Worth?

NEW appliances add a load roughly equivalent to the annual increase in domestic energy consumption and revenue. The gain in 1928 over 1927 in this class of business was 1,100,000,000 kw.-hr. and $53,201,000, according to analysis by the N.E.L.A. statistical research department.

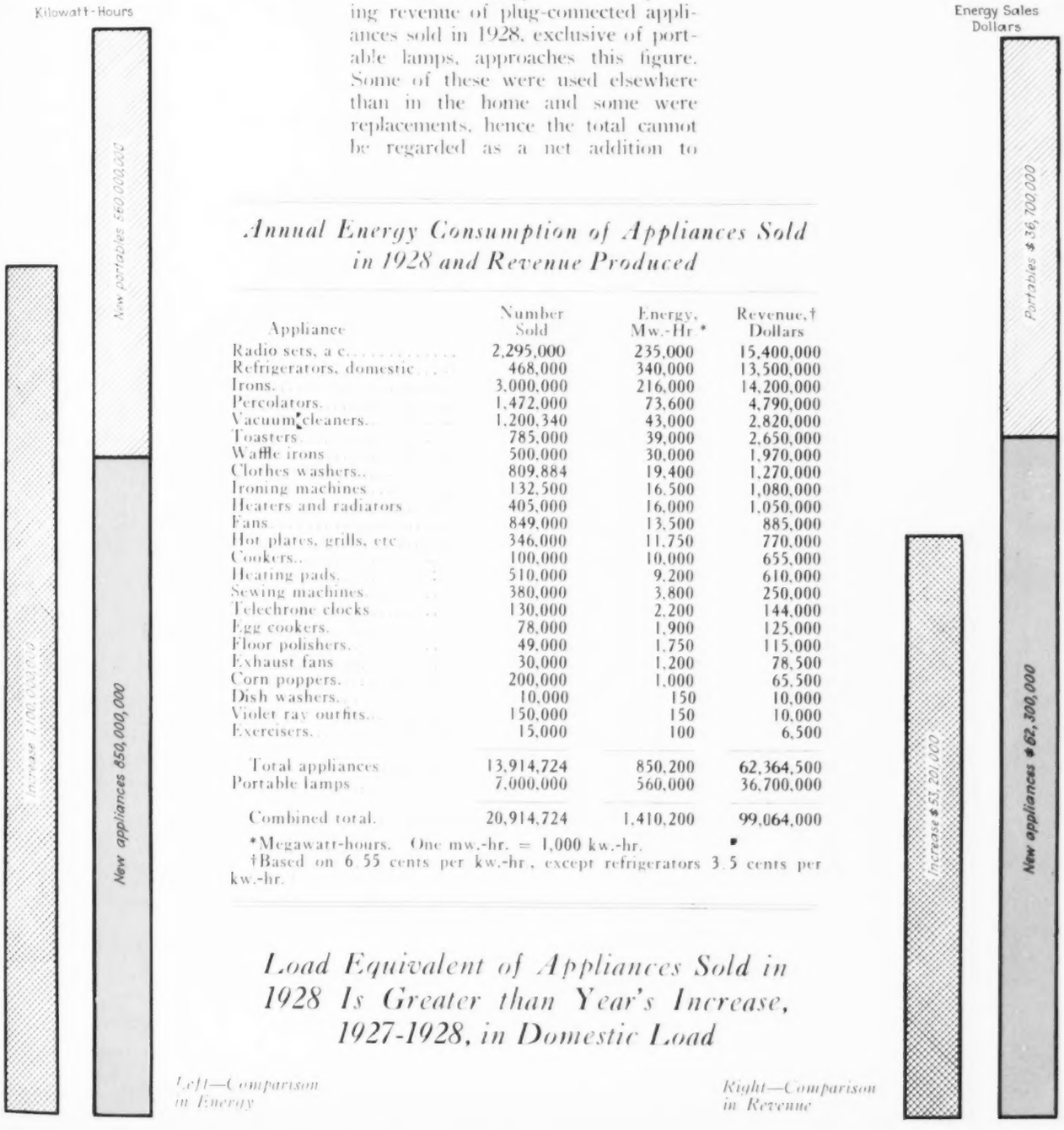
The total energy and corresponding revenue of plug-connected appliances sold in 1928, exclusive of portable lamps, approaches this figure. Some of these were used elsewhere than in the home and some were replacements, hence the total cannot be regarded as a net addition to domestic energy sales, but the comparison is instructive. Ranges and refrigerators, being permanently wired, are omitted.

Annual Energy Consumption of Appliances Sold in 1928 and Revenue Produced

Appliance	Number Sold	Energy, Mw.-Hr.*	Revenue,† Dollars
Radio sets, a.c.	2,295,000	235,000	15,400,000
Refrigerators, domestic	468,000	340,000	13,500,000
Irons	3,000,000	216,000	14,200,000
Percolators	1,472,000	73,600	4,790,000
Vacuum cleaners	1,200,340	43,000	2,820,000
Toasters	785,000	39,000	2,650,000
Waffle irons	500,000	30,000	1,970,000
Clothes washers	809,884	19,400	1,270,000
Ironing machines	132,500	16,500	1,080,000
Heaters and radiators	405,000	16,000	1,050,000
Fans	849,000	13,500	885,000
Hot plates, grills, etc.	346,000	11,750	770,000
Cookers	100,000	10,000	655,000
Heating pads	510,000	9,200	610,000
Sewing machines	380,000	3,800	250,000
Telechrone clocks	130,000	2,200	144,000
Egg cookers	78,000	1,900	125,000
Floor polishers	49,000	1,750	115,000
Exhaust fans	30,000	1,200	78,500
Corn poppers	200,000	1,000	65,500
Dish washers	10,000	150	10,000
Violet ray outfits	150,000	150	10,000
Exercisers	15,000	100	6,500
Total appliances	13,914,724	850,200	62,364,500
Portable lamps	7,000,000	560,000	36,700,000
Combined total	20,914,724	1,410,200	99,064,000

*Megawatt-hours. One mw.-hr. = 1,000 kw.-hr.

†Based on 6.55 cents per kw.-hr., except refrigerators 3.5 cents per kw.-hr.



Load Equivalent of Appliances Sold in 1928 Is Greater than Year's Increase, 1927-1928, in Domestic Load

Left—Comparison in Energy

Right—Comparison in Revenue

Radio Leads Load Builders

Manufacturer, dealer, central station and user are all concerned in appliances

APPLIANCE sales concern every branch of the electrical industry. The manufacturers produce not only the complete device but a host of accessories: 21,000,000 new appliances involve plugs, receptacles, cord, additional wiring, more circuits, fuses and outlets. Their load calls for more generator capacity, transformers and line construction.

Dealers, making the actual sales to the consumer, are directly interested.

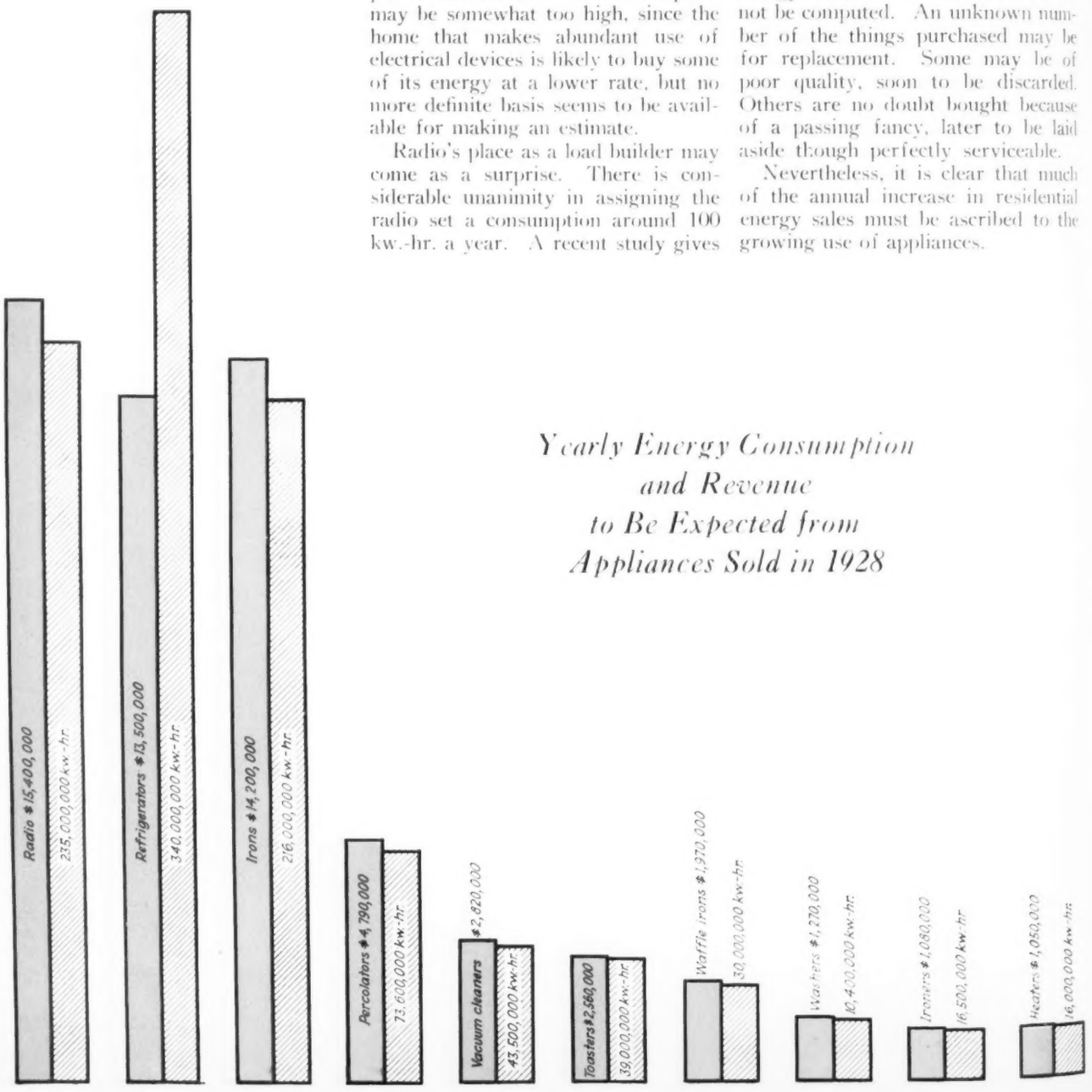
Central stations get additional load and revenue; how much they get is probably not always fully recognized. Users get increased convenience and save labor, at little expense.

The preceding page shows that the energy sales are comparable to the gain in domestic business. The estimates are based on the reported annual consumption of the individual appliances from the best available sources. The numbers sold are taken from the January, 1929, issue of *Electrical Merchandising*. The revenue is computed, with one exception, on the country-wide average price per kilowatt-hour. This assumption may be somewhat too high, since the home that makes abundant use of electrical devices is likely to buy some of its energy at a lower rate, but no more definite basis seems to be available for making an estimate.

Radio's place as a load builder may come as a surprise. There is considerable unanimity in assigning the radio set a consumption around 100 kw.-hr. a year. A recent study gives 103 kw.-hr. With 2,300,000 all-electric sets sold in 1928, the computed total, 235,000,000 kw.-hr., seems well-founded.

The chart on this page shows the standing of the ten leading appliances as load builders. Portable lamps, though computed at 560,000,000 kw.-hr., are not included because it is assumed that they replace, in general, rather than supplement the lighting from fixtures.

It is not correct to regard all this load as a direct addition to domestic energy sales. The exact revenue cannot be computed. An unknown number of the things purchased may be for replacement. Some may be of poor quality, soon to be discarded. Others are no doubt bought because of a passing fancy, later to be laid aside though perfectly serviceable.

Nevertheless, it is clear that much of the annual increase in residential energy sales must be ascribed to the growing use of appliances.

Yearly Energy Consumption and Revenue to Be Expected from Appliances Sold in 1928